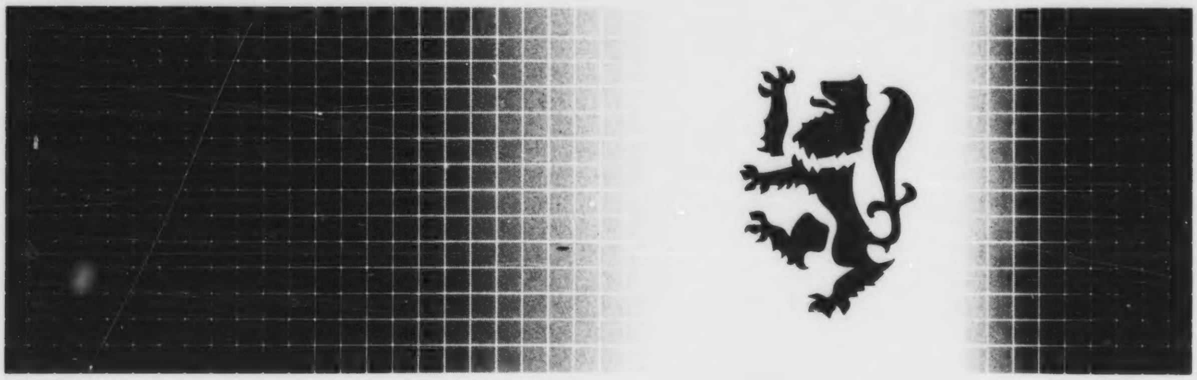
Information Technology Architecture Plan

Government of Nova Scotia



Final Report, April 12, 1991

Nova Scotia
Management Board

91-06933/

Information Technology Architecture Plan

The Information Technology (IT) Architecture Plan will be adapted in response to changing requirements and industry developments. Changes will be communicated in Manual 302, Government Systems Overview.

The IT Architecture Plan may be purchased at the Government Bookstore, One Government Place, 1700 Granville Street, Halifax Nova Scotia B3J 2R7. 902-424-7580 (toll free in N.S.)

Manual 302 is distributed internally by Management Board staff upon receipt of a written request signed by the Deputy Minister.

Both the IT Architecture Plan and Manual 302 are available in the Legislative Library, Province House, Granville Street, and in university and selected public libraries throughout the province.

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EXECUTIVE SUMMARY

Information Technology is an increasingly vital and powerful tool in business and government.

Used effectively, Information Technology (IT) can be a significant enabler to assist the Government of Nova Scotia in meeting the needs of its constituents. However, without a planned standards-based architecture, Government operations will be constrained by the existence of technology islands which prohibit innovations in service delivery and administrative functions. Management commitment and action are prerequisites for realization of Information Technology benefits.

Information Technology Architecture is the structure given to information, applications, work organization and technology - the components, their inter-relationships, and the principles and guidelines governing their design.

This Architecture Planning project was initiated by the Electronic Data Processing Advisory Committee (EDPAC) to address the need identified in the 1990 study, "Evaluation of Information Technology Planning". An inter-departmental steering committee directed the research and analysis used in the development of this architecture.

Benefits

Information Technology provides the communication and reporting mechanisms that allow for economies to be achieved through organizational changes such as:

- increased span of control;
- expanded delegation of responsibility/accountability; and
- greater decentralization with improved control and reduced management levels.

Information Technology will enable changes in work organization such as the empowerment of mobile employees (e.g. engineers, case workers, survey crews and Tax Commission auditors) who could use portable computers connected to central databases to support their field work.

IT will also enable new ways of delivering services, through multi-service centres where service delivery officers provide a variety of government services with the support of IT applications and databases. Extending this concept further, direct public access to government services could be achieved through highly functional, easy to use technology located at self-service kiosks. Some services could even be delivered at client homes. Such service opportunities include:

- obtaining information on Government programs and eligibility requirements;
- applying for and/or checking the status of such Government programs as student loans, home improvement grants, farm loans, fishery loans, etc.; and
- renewing permits, registrations, or licenses, including credit card payments.

The innovative use of Information Technology will have major impacts on Government and its clients, including:

- improved availability, responsiveness and quality of service throughout the Province, without additional costs;
- increased productivity of front-line workers;
- reduced service delivery costs and administrative overhead (e.g. through self-service approaches); and
- increased flexibility to change programs, service delivery and organizational models - Information Technology can be a catalyst for change.

Benefits have already been derived from the architecture planning process. The development of a series of Strategic Drivers and guiding principles (general architecture principles, work organization principles and others) will enhance the administration of Government. These Strategic Drivers and principles will greatly assist the management community to maintain a focus on items of strategic importance.

The planning process itself has begun to develop synergy by bringing together a number of people/departments with diverse views of Information Technology to converge on a common vision.

Migration Strategy

The target IT architecture described below involves a ten year plan which reaches for fundamental change across the IT infrastructure. Immediate changes to the existing installed base are not necessary; the architecture establishes a direction and a set of standards for planning structures and future acquisitions to achieve system integration and communication over time.

Coordinated strategies are required to reach the target IT architecture. The critical components are migration principles, plateaus, and interim coexistence strategies.

Migration is a series of three steps or plateaus leading to the target architecture: the first one, a 2 to 4 year timeframe; the second one, a 4 to 6 year timeframe, and the third one with a 7 to 10 year timeframe.

Action must be taken to initiate migration toward the target IT Architecture in the 91/92 fiscal year. Priority actions are the development of more comprehensive architecture/standards in some areas and technology trials and pilot projects in other areas. Departments will be requested to provide their migration strategies during this period.

Communicating the Architecture Plan both within Government and to outside groups such as vendors is critical to the successful adoption of the plan.

Technology Architecture

The Technology Architecture is comprised of four main components (see Figure 4.0 below):

- Workstations;
- Local Area Networks (LAN's);
- Processors; and,

- Wide Area Networks (WAN's).

These components and their associated standards are defined as follows.

Workstations

The intelligent workstation is the primary user interface in the proposed Architecture. The basic workstation is a personal computer comprised of a keyboard, monitor (screen), processing unit, main memory and optional disk storage. The workstation is capable of operating independently or as part of a network.

The workstation is the platform of choice for personal applications (e.g. document processing, decision support and graphics), data capture and development and design tools. The workstation also provides the user interface for applications on other platforms to which it is networked.

IBM-compatible microcomputers with MS/DOS have been chosen as the workstation standard. The main rationale is their suitability for the diverse requirements of Government, the large installed base in Government and their predominance in the marketplace. The introduction of Microsoft Windows 3.0 has given the IBM-based products ease of use features previously available only on the Macintosh. The range of hardware options combined with the growing selection of application software and development tools support this choice.

Local Area Networks

Local area networks (LAN's) are the vital first link in Government data communications. LAN's are private networks of computing devices within a workgroup, building or campus and do not require access to regulated carrier facilities.

In addition to providing high speed local communications, LAN's include basic file servers, print servers and an external communications gateway. LAN servers are also the preferred platform for such applications as electronic mail, document storage and retrieval local inquiry and reporting and small, work-group specific database applications.

Government of Nova Scotia

Information Technology Architecture (Overview)

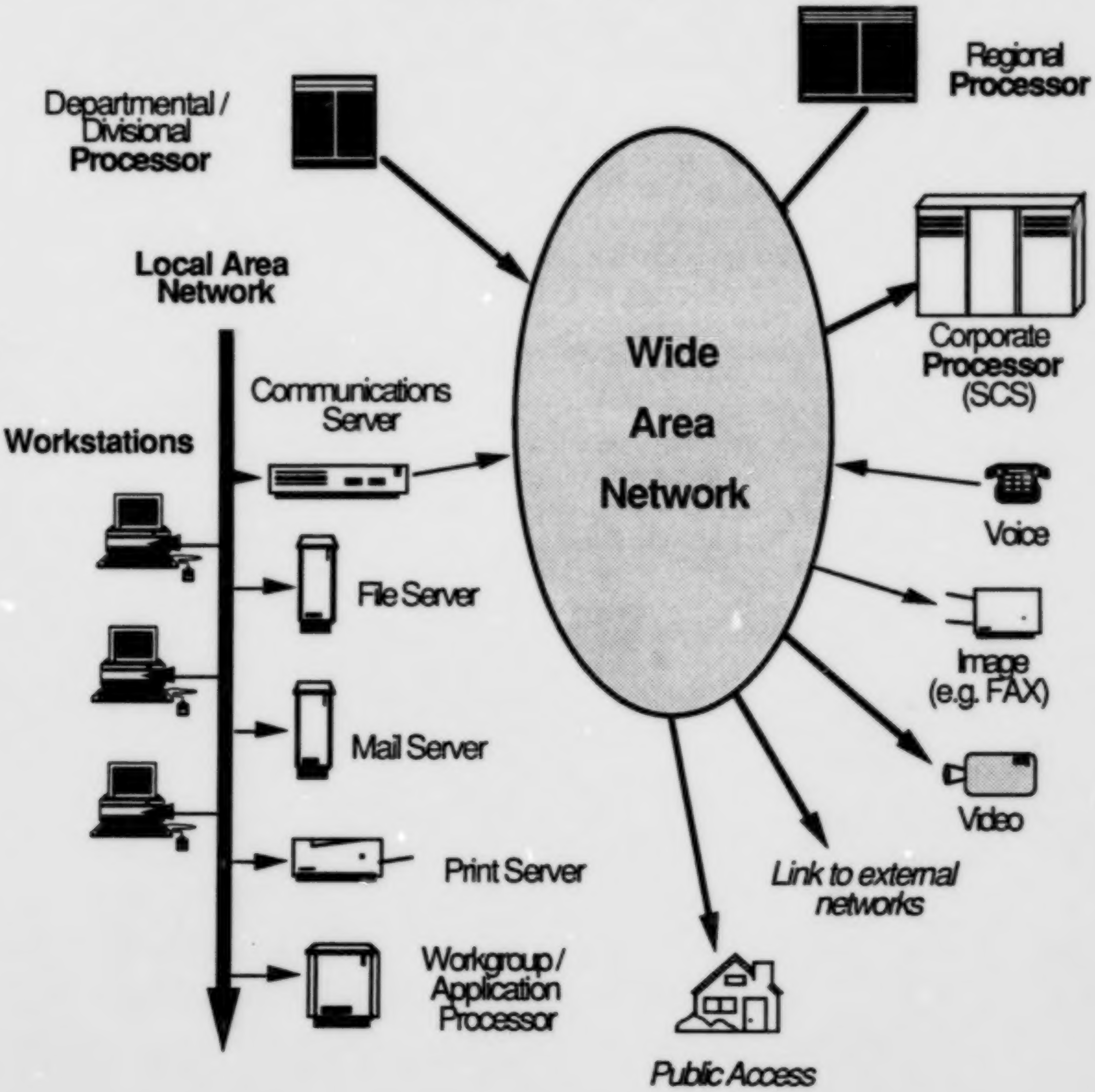

Departmental / Divisional Processor
Regional Processor
Local Area Network
Corporate Processor (SCS)
Communications Server
Wide Area Network
Workstations
Voice
File Server
Image (e.g. FAX)
Mail Server
Video
Print Server
Link to external networks
Workgroup / Application Processor
Public Access

Figure 4.0

The LAN operating system is one component of the architecture for which it is essential to establish a standard. The reason is that the LAN is the first level of interconnectivity in the architecture, linking local users to each other, sharing resources and giving workgroups access to the complete wide area network.

Novell Netware 386 was chosen as the standard LAN operating system mainly because of the company's dominant market share, the proven capabilities of the base product and its strong functionality, capacity and reliability. Recent announcements linking IBM and Novell serve to strengthen the product's position for the future.

Processors

Processors are the primary technology platform for delivering transaction processing applications and for maintaining shared Government databases. A processor may be a mainframe, minicomputer or microcomputer.

In accordance with dispersed business operations, four standard levels of processors are identified in the IT architecture: Corporate Processor(s), Regional Processors, Departmental / Divisional Processors and Workgroup / Application Processors.

In general, the trend in Government will be towards greater distribution of applications away from the Corporate mainframe and to a larger number of specialized application servers, often closer to the user community. The mainframe will continue as the primary server for Corporate applications and databases. The delivery of cost-effective quality service to clients will be the key factor in determining where applications and information reside.

In keeping with the Architecture Principles and industry trends , the Province has selected the Open Systems standards as a direction for all processor levels. The standards are centred around compliance with POSIX (i.e.*Portable Operating System for Computer Environments: An IEEE standard operating system interface...*). There will be a gradual migration towards this standard in conjunction with planned system upgrades and new applications.

Wide Area Network

The Wide Area Network (WAN) is at the centre of the Information Technology Architecture, serving as the "electronic communications highway" that links the Province. The role of the wide area network is to provide the required communications between all Government locations, users and devices across the Province. It must also allow for access from the public and other organizations.

In addition to the traditional transport functions, the WAN will also provide a range of services such as Government-wide Electronic Mail and Voice Mail, a common Electronic Data Interchange (EDI) facility and access to a common Electronic Funds Transfer (EFT) service for handling financial transactions.

The wide area network architecture will adopt the Open Systems Interconnect (OSI) standards. OSI sets out the accepted international standards by which "open systems" should communicate with each other.

The wide area network is a critical component of the infrastructure required to take advantage of Information Technology throughout the Province. Based on the recommended network computing architecture, there is a need to plan the evolution of the WAN to meet the new and growing requirements across Government. An initial investment will be required to implement the necessary changes to the infrastructure. However, savings in overall communication costs may offset such an investment within a short period.

Development Environment

In addition to the four primary components of the IT Architecture, the Architecture Planning project also sets out directions for the Systems Development Environment.

The development environment is the integration of a method, standards, development tools and common techniques covering the development cycle, with the aim of designing and building information systems. The productivity of the development environment depends on the effectiveness of each of its parts and on the quality of their integration.

The key recommendations for the target development environment are as follows:

- Implement the Productivity Plus™ development methodology (already adopted by the Department of Government Services) as the Government-wide standard;
- Implement a standard systems developers' workbench with appropriate tools to support all stages of development and testing;
- Standardize on the Software AG environment for professional applications development across Government; and
- Implement a standard Government-wide project management approach and supporting project reporting practices and tools.

Summary

In summary, Information Technology is a vital tool for the Provincial Government to deliver high quality, cost-effective services into the future. The proposed standards-based architecture is key to Government's ability to deploy integrated and compatible technology solutions for both internal and external use. Government should take immediate steps to adopt, promote and evolve the recommended architecture and associated standards.

1.0 INTRODUCTION

As highlighted in Government strategic planning documents, departments and agencies are now in the "Information Business". Information systems and technology are becoming increasingly important in the administration and delivery of services to the public. As well, rising public expectations combined with budget constraints are forcing government to do more with less. Information Technology (IT) is a vital resource to successfully meet these challenges.

To enable the Province to fully realize the opportunities presented by IT, Management Board initiated a study in the Spring of 1990 to evaluate new planning approaches for IT. The study, conducted by DMR Group Inc., developed recommendations for five "key thrusts" as follows:

1. Focus and revitalize Government's strategic planning initiatives;
2. Build IT awareness and vision among Government policy makers;
3. Develop a cross-departmental IT strategy;
4. Define IT architectural requirements; and,
5. Address IT organization and staffing needs.

Action plans were identified for each recommendation and in particular, Recommendation 4. to "define IT architectural requirements". This Architecture Planning project was initiated in December, 1990 with the following objectives:

- Establish an interdepartmental working group to initiate architecture planning and provide the necessary training on architecture planning frameworks and approaches;
- Conduct an assessment of existing technology architectures and inventory across Government;

- Update the knowledge of key industry developments and directions with respect to IT architectures and standards, including both leading vendors and open systems capabilities;
- Develop an initial conceptual architecture to meet cross-departmental needs and provide effective integration for both internal and external requirements;
- Identify and prioritize areas where standards and guidelines are required, such as networking, data base, common services, user interfaces, development environments, operating systems and technology platforms;
- Develop a plan for building work organization, application and information architectures for key opportunities identified in the IT strategy; and
- Initiate the process for developing the required standards and guidelines.

The Architecture Planning project highlights the importance and potential benefits of adopting architectural standards. It does not address the specific costs and financial benefits of implementing the recommended architecture. Rather, a business case must be prepared at the detailed planning stage for each initiative.

An IT Architecture Planning Steering Committee and six working groups (See Figure 1.0) were established to undertake this project. Each working group developed the recommendations and standards for its segment of the project. DMR Group was contracted to provide facilitation support and specific technology expertise. This report and accompanying appendices document the key findings and recommendations of the Information Technology Architecture Planning project.

Planning Team Structure

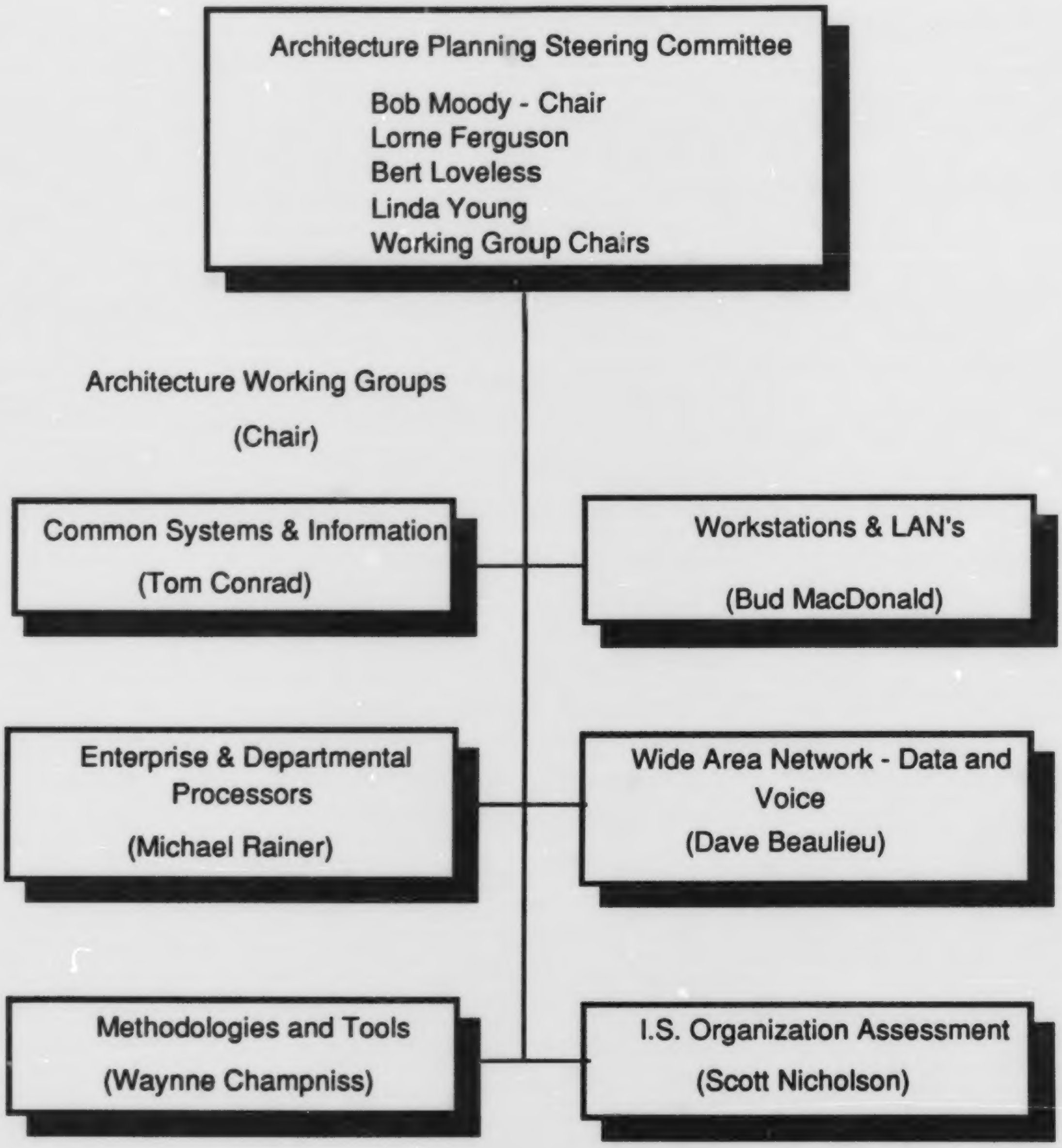

Architecture Planning Steering Committee
Bob Moody - Chair
Lorne Ferguson
Bert Loveless
Linda Young
Working Group Chairs
Architecture Working Groups
(Chair)
Common Systems & Information
(Tom Conrad)
Workstations & LAN's
(Bud MacDonald)
Enterprise & Departmental Processors
(Michael Rainer)
Wide Area Network - Data and Voice
(Dave Beaulieu)
Methodologies and Tools
(Waynne Champniss)
I.S. Organization Assessment
(Scott Nicholson)

Figure 1.0

2.0 INFORMATION TECHNOLOGY ARCHITECTURE PLANNING

This chapter reviews the evolution of the IT industry towards open systems architectures, provides a generic framework for defining and evaluating IT architectures, and presents an overview of the architecture planning and implementation process. Each of these topics is dealt with in detail in the ***Stage IV Report*** from the ***Strategies for Open Systems*** program conducted by DMR Group Inc.

2.1 Evolution of Information Technology

Fundamental changes in the business environment coupled with new technological capabilities are transforming the way we conduct business, and use technology to support the business. This necessitates the adoption of a fundamentally new approach to IT architecture, in effect a shift to a new era of information technology.

Today's enterprises are locked into the technology of the past with isolated data processing systems that are costly and difficult to maintain. These system islands are self-perpetuating as applications continue to grow. The need to address the problem is urgent, for the longer an organization waits, the more costly and disruptive the conversion becomes.

Architecture was not much of an issue in the first era of information technology. For most enterprises there was no disciplined organization of information technology in support of a business vision. Rather, the architecture could be better described as the historical sum of various systems implemented over the years to address particular business requirements.

The result has been systems which are not integrated, highly fragmented, overlapping in function and information, and incurring large costs for redundancy and maintenance. The lion's share of the information systems dollar goes toward maintaining old systems rather than in building new applications to respond to new business needs. New applications that are undertaken seem to take forever to build.

The first era systems also tend to be inflexible based on the old model of host computing based on mainframe and mini computers, each supporting its own network of terminals. Hosts were optimized for system efficiency given the high costs of traditional technology. The early architectures were actually product architectures, with a resulting lock-in effect because of the major cost and impact of converting between different product lines.

Clearly the traditional approach to deploying computer and communications technology will not meet the business needs of the 1990's. By all indications, this will be a decade of major transition in the way business is conducted, a time to rework strategic programs based on quality service and efficiency.

Two key forces emerged in the 1980's which enable the shift to the second era of information technology. The first of these was distributed computing, the concept of moving computing resources out closer to the operational areas of the business. The second force was the arrival of the personal computer which brought distributed computing down to the desktop and ultimately the briefcase. More importantly, the relatively low cost of the PC's opened up many new application areas, especially for knowledge workers who had not been well served by earlier technology.

The trend towards distributed computing highlights the need for standards as the basis for linking different types of computing and communications platforms from multiple vendors. The integration of previously disparate applications of technology can only be achieved by providing an infrastructure based on standard components and interfaces. This infrastructure can then be used to further the strategic use of technology in ways which significantly improve business operations.

For the first time it is now feasible to achieve a coherent, evolutionary, enterprise-wide architecture based on a vision of the needs and future of the organization. Information technology, standards and the IT industry have matured sufficiently to define an architecture, owned by the organization, and independent of specific IT vendors. The goal of such an architecture is to provide a cost-effective means of supporting enterprise-level requirements while encouraging innovation within individual departments.

2.2 IT Architecture Overview

IT architecture describes the technology infrastructure required by a business to attain its objectives and achieve a business vision. It is the structure given to information, applications, work organization and technology - the components, their inter-relationships, and the governing principles and guidelines.

Standards-based IT architectures provide a flexible platform to deliver commonly required information and applications across the organization. They also adapt to accommodate evolving business requirements and innovations in technology. Standards enable architectures to be modular, vendor independent and loosely coupled with interchangeable parts.

An architectural framework supports the definition of the target IT environment (see Figure 2.2). The framework presents a consistent picture of the architecture from several inter-related viewpoints:

- The **Business Context** describes the business and shows how the operations will benefit from the changes enabled by IT. It provides the business strategists' view of the architecture. The Business Context is defined in terms of the business functions, the classes of potential users and the generic locations where work is performed.
- The **Application Model** describes those functions of an organization which can be supported or automated through IT. It is used for grouping or clustering functions into applications. It provides the application developers' view of the architecture.
- The **Information Model** describes the information resources of the organization and their inter-relationships. It provides the information resource managers' views of the architecture.

Architecture Models

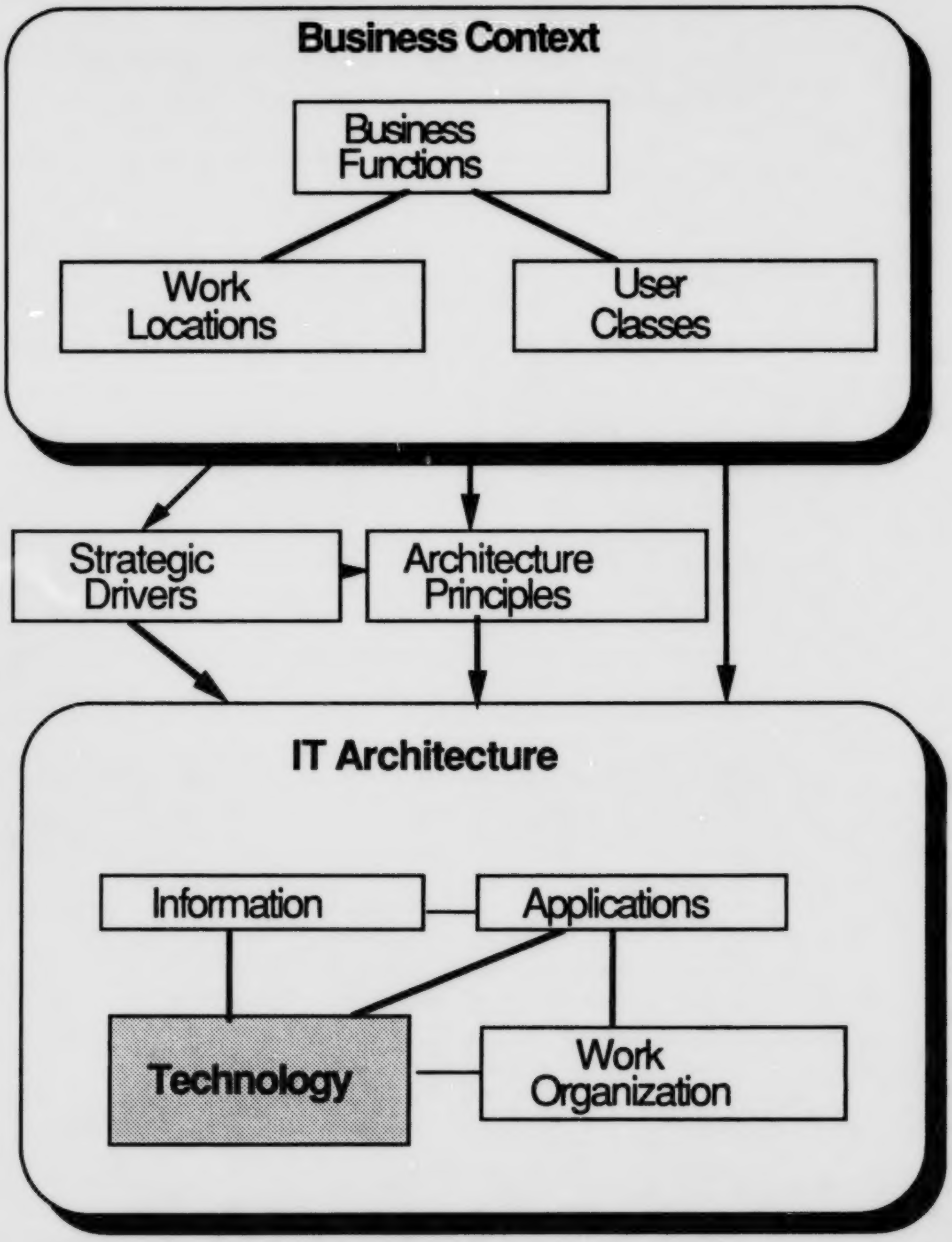

Business Context
Business Functions
Work Locations
User Classes
Strategic Drivers
Architecture Principles
IT Architecture
Information
Applications
Technology
Work Organization

Figure 2.2

- The **Technology Model** defines the components of the technology infrastructure which support the other architectural models. This is where the enabling effect of standards-based architectures is felt the most. The technology model provides the technology managers' views of the architecture.
- The **Work Organization Model** describes the impact on business operations at the work group and user level. It is used by organizational change designers to manage the impact of introducing new systems. It provides the user view of the architecture. (In this project, some Work Organization issues such as work locations and user classes are addressed in the Business Context. Detailed design of work organization architecture should be included with each implementation project.)

While the focus of this project is on the Technology Architecture, the business, applications and information models drive the technology requirements.

The overall direction of the architecture is guided by strategic drivers and architecture principles.

- The **Strategic Drivers** are the major thrusts of an organization which define strategic initiatives and provide direction to the planning and management activities.
- The **Architecture Principles** are statements of preferred architectural direction or practice. They are statements of how an organization wants to employ information technology over the long-term.

In summary, an effective IT Architecture must address three primary goals:

- It must provide a cost-effective means of organizing Information Technology to support the organization's objectives;

- It must improve the effectiveness of IT in delivering new capabilities to the organization; and

- It must facilitate the cost-effective evolution of the IT infrastructure and solutions over time.

2.3 Architecture Planning and Implementation

Architecture planning is the process of transforming a business need for computer-based systems into a planned and organized framework which supports integration and systems delivery. The two main questions faced by organizations embarking on the implementation of an IT architecture are:

- by what process can we define an architecture that meets our business vision?

- how do we get from here to there?

Large organizations, for example, cannot discard major investments in proprietary applications and hardware and suddenly switch to an operating system such as UNIX merely because it is more "open" than the proprietary one. Similarly, users who have a considerable investment in MS/DOS machines cannot adopt Windows 3.0 overnight if the change requires implementation on several hundred existing workstations.

For organizations to adopt open systems architectures, they must follow a proven method for defining and migrating to an enterprise-wide, standards-based architecture. The phases and deliverables in the Architecture Planning process are as follows:

1. **Architecture Framework:** The current environment and architectural direction for the target architecture are described.

2. **Baseline Definition:** The current application and technology base is inventoried and documented.

3. **Target Architecture Definition:** A standards-based target architecture is defined and documented.

4. **Implementation Opportunity Identification:** Opportunities for specific system implementations are identified and prioritized.

5. **Migration Options:** Implementation options for migrating to new target architecture are defined and evaluated.

6. **Harvesting Benefits:** Short-term payoff programs, derived from the new standards-based architecture, are identified, categorized and implemented.

7. **Reality Testing the Architecture:** Stress tests of the new architecture are made on a continuous basis to ensure that it works. It is modified as the business, organization and technology changes.

The IT Architecture Planning project at the Nova Scotia Government is based on this approach.

3.0 ARCHITECTURE CONTEXT

This section describes the business characteristics and directions that the IT Architecture must support and introduces the principles used to guide the Architecture.

3.1 Business Context

Governments across Canada currently face mounting debt and economic slowdown. The Province of Nova Scotia, like its counterparts, is under extreme pressure to cut programs and reduce administrative costs. Moves to increase efficiencies and consolidate departments must be supported by information and systems to enable newer, more effective means of program delivery. Concepts such as multi-service centres and client self-service must be considered as alternatives to traditional departmental delivery systems.

Information Technology is a primary vehicle to assist Government in reducing costs while maintaining and improving service to the public. One of the key roles of IT is to enable a restructuring of work organization and management processes. The following section describes the evolving impact of information technology on management principles.

3.1.1 Information Technology and Management

Management is commonly defined as a process consisting of **planning, organizing, implementing** and **evaluating**, performed to determine and accomplish the organization's objectives. **Communication** is interwoven among these components of the management process.

Information technology impacts all aspects of the management process.

- **Communication**
  The methods and relative effectiveness of communication have been greatly improved through such technologies as facsimile, electronic mail and video conferencing.

- **Planning**
  Access to major databases, modeling tools and simulation technology now allow managers to effectively plan for more complex issues and programs over longer periods of time.

- **Organizing**
  Information Technology provides the communication and reporting mechanisms that allow for organizational change such as:

  - increased span of control (i.e. above the traditional 6-12);
  - expanded delegation of responsibility / accountability;
  - greater decentralization with improved control;
  - reduced management levels; and
  - enabling delivery of multiple services with the support of interactive information systems.

- **Implementation**
  Information Technology facilitates the implementation stage to enable more cost-effective and flexible solutions.

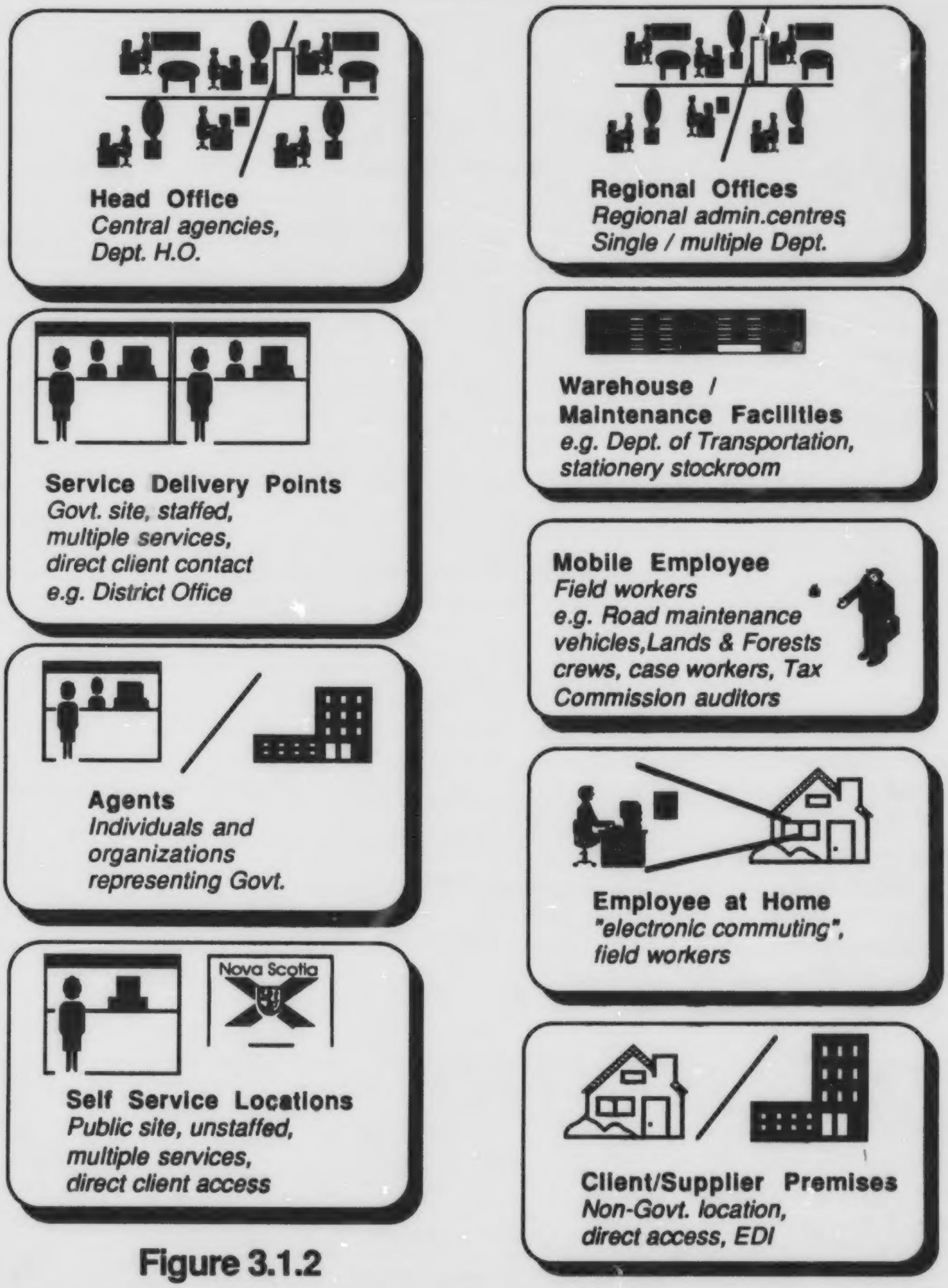
- **Evaluation**
  Information Technology allows virtually instantaneous tracking of program results and costs which in turn provides meaningful input to the planning phase.

Information Technology is clearly a vehicle for restructuring Government and improving service to the public. However, it is only through management commitment and action that the full benefits of IT can be realized.

3.1.2 Business Models

This section provides models of the **business functions** of Government, the **work locations** and the classes of potential **system users**.

Work Locations



Head Office
Central agencies,
Dept. H.O.

Service Delivery Points
Govt. site, staffed,
multiple services,
direct client contact
e.g. District Office

Agents
Individuals and
organizations
representing Govt.

Self Service Locations
Public site, unstaffed,
multiple services,
direct client access

Regional Offices
Regional admin.centres
Single / multiple Dept.

Warehouse / Maintenance Facilities
e.g. Dept. of Transportation,
stationery stockroom

Mobile Employee
Field workers
e.g. Road maintenance
vehicles,Lands & Forests
crews, case workers, Tax
Commission auditors

Employee at Home
"electronic commuting",
field workers

Client/Supplier Premises
Non-Govt. location,
direct access, EDI

Figure 3.1.2

With over 20 departments and numerous agencies, the business of government is diverse and complex. In architecture planning, it is necessary to consider the business in generic terms to architect solutions that will satisfy the broad needs of all departments.

Business Functions

The generic business functions of Government are defined as follows:

Policy and Planning: Setting of goals and objectives, development of strategy, business plans, information technology plans, and program evaluation;

Develop and Implement Programs: Execution of strategy through development and implementation of specific program activities; the essentials of planning, organizing, controlling and directing programs. This function excludes the day to day operation of programs;

Internal Administration: Staffing, human resource management, budgeting, financial accounting;

Providing Grants and Payments: Grants and ongoing payments provided to program clients. (e.g. social assistance, municipal grants, school funding);

Administering Licenses, Permits and Registrations: Processing application, re-applications and renewals, issuing documents, and maintaining records (e.g. Driver's Licenses, Vehicles Permits, Hunting/Fishing Licences);

Inspecting and Auditing: Performing health and safety inspections, auditing use of grant monies;

Assessing: Property assessment, eligibility for services;

Consulting and Counselling: Client business planning, commercial and personal financial counselling, physical and mental health counselling, lifestyle counselling;

Patrolling and Protecting: Lands & Forests patrols, policing, correctional services, child protection;

Adjudicating: The court system, Rent Review Agency, assessment appeal boards, Labour Relations Board, Public Utilities Board, and Social Assistance Appeal Board;

Collecting Revenues: Provincial Sales Tax collection, transfer payment negotiation, service fees, license fees, product sales;

Construction & Maintenance: Highways and bridges, buildings, recreational facilities;

Distributing Information: Responding to public inquiries, dealing with media requests, vital statistics, Registry of Joint Stock Companies, property assessment rolls;

Distributing Goods: Nova Scotia Liquor Commission, N.S. Government Bookstore, School Book Bureau;

Conducting Research: Analysis of statistical information, collection, analysis and reporting of primary data, conducting experiments;

Training and Education: Community college programs, apprentice trades, fisheries training, business development programs;

Health Care and Rehabilitation: Public health units, school dental hygienists, Commission on Drug Dependency, N. S. Rehabilitation Centre, young offenders facility, correctional services offender rehabilitation;

Acquiring Goods and Services: Purchases made through departments having tendering authority, use of N.S. Purchasing Agency; and

Marketing and Promotion: Promotion activities, market planning and development.

Work Locations

Information Technology enables Government to operate equally effectively from any number of locations. In general, the trend will be towards a more decentralized operation in which the front-line workers are empowered to deliver a variety of services directly to the client. Considering future work distribution, IT Architecture planning considers nine types of locations where Government business can be done. These work locations are illustrated in Figure 3.1.2 and are described as follows:

Head Office: Location where a Department's most senior management levels reside, having a predominantly staff focus. If services are delivered from this location, these activities are considered to be logically separate from Head Office, and are considered as a Service Delivery Point. Similarly, the Regional Office for Halifax may well reside in Head Office, but is logically a distinct work location.

Regional Office: Physically or logically separate from Head Office, usually geographically dispersed, having some of the same predominantly staff functions found in Head Office. At present, Regional Offices are departmental in nature, but may share facilities.

Service Delivery Point: A fixed location responsible for client contact and provision of direct client service.

Warehouse/Maintenance Facility: Department of Transportation maintenance garages, School Book Bureau, NSLC Distribution Centre, stationery stockroom, Lands & Forests repair facility.

Mobile Employee: Road maintenance vehicle, Lands & Forests patrols, Department of Transportation inspectors, public health inspectors, community services caseworkers, tax auditors, property assessors, building inspectors, labour inspectors.

Agent: An individual or organization empowered with some or all of the authority of a government employee, with responsibility for providing public service or for conducting a transaction on behalf of Government. Fishing/hunting licenses are one current example.

Self Service Location: An unstaffed "kiosk" equipped with a specialized workstation for use by the general public for access to government applications. Will be located in public places such as shopping malls, airports, public gathering places.

Supplier/Client Location: Access to government applications from remote supplier or client locations i.e.. home, vehicle, or office.

Employee at Home: Known as electronic commuting, employees will be capable of performing job functions from home with the installation of intelligent workstations linked to the government computer communications network.

User Classes

User Classes are a means of categorizing the various groups of Information Technology users in the Government of Nova Scotia. Specific applications and technology are required to support the different roles performed by each user class. The user classes identified in the Nova Scotia Government are as follows:

Executive: Executive users include Ministers, Deputy Ministers, Executive Directors and Directors. This class of user has had limited direct exposure to Information Technology. The introduction of IT to this group will require special training and support programs.

Professional and Technical: The Professional/Technical user class includes personnel such as engineers, accountants, economists, administrators and managers. The exposure to IT within this group has been expanding rapidly. This group is anxious to learn and use new technology and skills.

Clerical and Administrative Support: The Clerical and Administrative Support user class includes clerical, secretarial and other administrative personnel. This user class has a high level of exposure to IT and are currently the largest user class. In most cases exposure has been limited to single applications or functions.

Systems Development Specialist: The Systems Development Specialists user class includes programmers, analysts, designers, project leaders and managers. Systems Development Specialists are a sub group of the Professional/Technical class who require specialized functions. The intelligent workstation will be used by this class to design, develop and test systems.

Service Delivery Officer: The Service Delivery Officer user class includes personnel who interact directly with the consumer of government programs and services. This class includes positions such as caseworkers, Registry of Motor Vehicle tellers, health inspectors and municipal assessors. The effective use of IT will have a major impact on the level of service provided to the client. This user class will be empowered to make complete program eligibility decisions. It is imperative this user class have access to applications and databases regardless of business location. The Service Delivery Officer should be able to provide a complete service or function from start to finish. Portables, cellular phones, intelligent workstations, communications and software will assist the officer in providing faster and more efficient service.

Supplier: The Supplier user class includes those individuals, businesses and organizations that provide goods and services to the government. Major suppliers should be linked electronically to obtain detailed information of goods required. EDI (electronic data interchange) provides the capability of electronically exchanging information for viewing and creating purchase orders, bids, quotes and invoices and provides payments to suppliers through automated bank transfers.

Client: Client is the user class made up of those individuals and organizations (internal and external) to whom government departments and agencies provide goods or services. In the future clients will be empowered to interact directly with various government departmental databases to obtain information and/or services.

Agent: The Agent user class includes businesses and organizations that provide services or goods to the public on behalf of government departments. This class includes vendors that collect taxes on behalf of the province, sell licenses, provide goods and services on behalf of government. These agents will in fact become an extension of the government and will be empowered to provide the same level of service as the Service Delivery Officers.

Other Governments: The Other Governments user class includes Federal, Provincial, and Municipal governments. The sharing and transmittal of data electronically through EDI will be used extensively. Shared databases will be available to all levels of government.

3.2 Strategic Drivers

Following the recommendations of the *Evaluation of IT Strategic Planning Study*, the EDP Advisory Committee formed a working group to define a set of "Strategic Drivers". The Strategic Drivers are intended to direct the application of Information Technology across Government to ensure that it effectively supports overall Government strategy.

The Strategic Drivers serve as the primary business criteria in the development of the Architecture Principles and in the design of the IT Architecture. The six Drivers in priority sequence are as follows (They are described in detail in Appendix B.):

1. The prioritization of Information Technology initiatives and investments must reflect **Government priorities.**

2. Investments in Information Technology must support the Government's **fiscal strategy** by reducing expenditures and/or increasing revenues.

3. Information Technology must focus on meeting evolving requirements for **client service.**

4. Information Technology must be used to simplify and **streamline Government** structures, processes and procedures.

5. Initiatives in Information Technology must support the Government's **economic development** strategy.

6. Information Technology must provide information and tools which support informed **management decision making**, and accountability.

The Strategic Drivers provide direction for developing the Architecture Principles and recommended Technology Architecture. As well, they have become key factors in evaluating proposed IT projects and departmental Long Range Systems Plans.

3.3 Architecture Principles

Information Technology Architecture Principles are simple, direct statements of preferred architectural direction to support the business strategy of Government. The principles help to establish a common language for business managers and technology managers in making technology-related decisions.

Architectural principles are analogous to zoning laws that define the basic rules for the use of property. In the case of IT, architectural principles establish an organization's attitudes toward the role IT will play in the business. For example, will IT have a passive, supportive role, or will it be applied progressively and proactively to transform the organization?

The Nova Scotia Government IT Architecture Principles have been developed in a series of workshops with the project Steering Committee. The Principles cover five areas as follows:

- **General Principles** which apply to the overall IT Architecture;
- **Work Organization Principles** which guide how information technology should support work organization;
- **Application Principles** relating to the development and implementation of applications;
- **Information Principles** which guide the role and placement of information resources; and
- **Technology Principles** which cover the application and selection of technology.

Each principle is a statement of preferred architectural direction. Deviations from a principle must be supported by solid business or technological rationale. The principles should be reviewed on an ongoing basis to ensure that they continue to reflect the prevailing needs and attitudes of Government.

The following is a list of the Architecture Principles. Appendix C provides more complete descriptions including rationale and implications for each principle.

General Principles

1. **Integration**

   The I.T. Architecture must provide the capability for integrating and managing the diverse and dispersed business operations of Government.

2. **Client Focus**

   Systems will be planned and developed to address the needs of Government clients.

3. **Flexibility**

   The I.T. Architecture should promote the development of information systems that can both enable and respond to changing business conditions and technology upgrades in a timely and cost-efficient manner.

4. **Common Business Functions**

   Across all departments and agencies, Government will identify and exploit opportunities for common functions to take advantage of standard applications, information and technology.

5. **Industry Standards**

Choices for application and system components will be based on industry standards where applicable and available, and preference will be given to standards which are supported by multiple vendors.

6. **Leveraged Development**

I.T. solutions will make use of purchasable, sharable and reusable components as much as possible rather than custom designing and developing.

7. **Methodologies**

Applications, information, and technology should be planned, developed, implemented and maintained using a consistent set of methodologies and tools across all departments and agencies.

8. **Risk Management**

The I.T. Architecture will provide secure operation and ensure the integrity and confidentiality of Government information in accordance with established security and service levels.

Work Organization Principles

1. **Data Capture**

Data will be captured once, as close to the logical source as possible, including external sources.

2. **Digital Form**

Information will be stored and transferred between parties (internal and external) in digital form where feasible and cost effective.

3. Access to Information

Information will be made available in an effective manner to those who are entitled to view it, including clients and external users.

4. Flexibility

The I.T. Architecture should support employees who perform multiple roles, independent of location and organization structure.

Application Principles

1. Common Requirements

Where common requirements exist, the planning and development of application systems will promote the use of Corporate systems (e.g. HRMS, Finance), shared interdepartmental systems (e.g. Justice, Home Care) and common decentralized systems (e.g. Inventory, Library Systems).

2. Reusability

Application systems should be structured to use standard components and processes across Government (e.g. name and address processing, account verification, direct deposits).

3. Application Placement

Cost-effective, quality service to clients will be the primary factor in determining where an application should reside.

4. Separation by Type

The architecture will promote the separation of applications and information that provide transaction processing, decision support and report processing.

5. User Interface

Within a given user class and workstation type, applications should present a common user interface that is adaptable and extendable to particular user requirements.

6. Information Exchange

Electronic information exchange should be conducted using exchange applications which are based on a standard set of formats and protocols (e.g. file transfer).

Information Principles

1. Forms of Information

The Government architecture and implemented systems must accommodate the use of all forms of information (data, text, voice, image).

2. Placement of Information

Cost-effective, quality client service is the primary focus for determining the level of distribution of information.

3. Standard Data Definitions

Information definitions will be standardized across all Government departments and agencies.

Technology Principles

1. Flexibility

The Nova Scotia Government will choose technology components such that expansion, reconfigurations, upgrades and substitutions can be easily accomplished.

2. **Multiple Levels**

   Processing, storage, communication, and workstation technologies must be placed at multiple levels in the architecture in accordance with dispersed business operations.

3. **Intelligent Workstations**

   Intelligent workstations will be the primary means of interfacing with applications.

4. **Network Standards**

   The Nova Scotia Government will use a common set of network environments standards to interconnect all workstations, computers, and communicating devices.

5. **Common Services**

   Common services such as file transfer, electronic mail, directory management, and network management should be provided through an integrated networking environment(s).

3.4 Application and Information Models

Information Technology supports the business needs of Government through the delivery of applications and information. Given the diverse requirements of various departments, the application and information models must be expressed in generic and conceptual terms. The application models are based on "Generic Application Environments" and the information models on "Information Classes" within Government. The purpose of these models is to depict the *nature* of applications and information that the technology architecture must support.

3.4.1 Generic Application Environments

Generic Application Environments (GAE's) are different types of application capabilities used to achieve a productive end use of information technology. GAE's are used to classify and qualify the requirements of the automated business functions into meaningful IT applications. The concept of Generic

Application Environments is a critical link between the Government's evolving application requirements planning and the introduction of standards-based architectures.

The DMR report *"Strategies for Open Systems"* describes a number of Generic Application Environments. The Steering Committee has chosen 11 of these for consideration in this IT Architecture Plan. These are as follows:

1. Transaction Processing (online)
Transaction Processing environments support online capture and processing of information in an interactive exchange with the user. These typically involve predetermined sequences of data entry, validation, display, and update or inquiry against a file or data base.

2. Data Capture (batch)
Data Capture environments are characterized by the entry of transaction data into a queue or batch file for later processing. The transaction entry may involve extensive online editing but no updating. The subsequent batch processing may update files or data bases and may trigger a reporting function.

3. Inquiry Processing
Inquiry Processing environments support business activities requiring interactive selection, extraction, and formatting of stored information from files and data bases. They are used in conjunction with batch and transaction processing environments to provide information retrieval, using either structured (routine) or ad hoc (definable) queries. The output may be on a workstation or printer. Inquiry processing environments are intended to replace the need for extensive reporting systems by providing only the requested information.

4. Reporting
Reporting environments support business activities requiring regular scheduled structured reports. In these environments, reports are generally produced as batch jobs and may involve database updates. These environments are currently on the decline and are being replaced by inquiry environments which provide only the requested information rather than extensive reports.

5. Decision Support

Decision Support environments provide interactive modeling, and simulation tools which allow the user to analyze the effects of alternative decisions. These modeling and simulation tools typically work in conjunction with files and data bases which were created from batch or transaction processing environments.

6. Expert Systems

Expert Systems environments use a type of artificial intelligence built with inference engines and knowledge or rules bases which take or recommend actions based on presented situations and past experience. They are used to augment human decision making processes where the expertise or logic of the decision maker can be defined as rules.

7. Document Storage and Retrieval

Document Storage and Retrieval environments are used to retain large volumes of stored information in document formats. Originally these systems were based on microform media using film or fiche with special readers to magnify the information. More recent introductions of optical storage technologies are allowing for storage of scanned or computer-produced documents using digital storage techniques. These are now available for use on PC networks as well as for large corporate applications such as archiving.

8. Document Processing

Document Processing environments extend the basic capabilities of text processing to take advantage of the graphics capabilities of today's workstations and laser printers. Consequently, they provide powerful document and presentation tools for the end user.

9. Electronic Mail

Electronic Mail environments support the storage and forwarding of directed messages, mail, and other documents or files between a sender and one or more recipients. They provide the sender with facilities to create or define the message(s) or file(s) to be sent, to use directories and distribution lists for routing information, to assign priorities, to use pre-formatted electronic forms, and to trace the status of messages sent.

10. Systems Development
Systems Development environments provide those applications required to support the full range of system development activities including analysis (e.g. modeling), design, programming and testing. A list of the potential system development tools is presented in Section 5.5.

11. Imaging (Computer-aided Drafting/Design)
Imaging (CAD) environments support the creation, storage and retrieval of precision graphical designs with integrated databases. These environments typically support engineering design, architecture and drafting.

The remaining Generic Application Environments are as follows:

- Real Time Control;
- Text Processing;
- Electronic Publishing;
- Hypermedia Processing;
- Video Processing;
- Voice Mail;
- Enhanced Telephony;
- Shared Screen Teleconferencing;
- Video Teleconferencing;
- Broadcast; and
- Computer Conferencing.

These GAE's have been excluded at this stage in order to focus on the areas of most immediate concern to Government. However, some of the video, voice and conferencing applications should be considered over the next few years.

3.4.2 Information Classes

An Information Class is a high-level definition of related data entities. Information Classes are intended to identify common information requirements across various Government departments. Frequently today, each department or program maintains its own data in its own format, making it virtually impossible to maintain consistency or to obtain a consolidated view of any data subject.

Moving towards common databases will require some lessening of access restrictions imposed by current program requirements and Government legislation.

The primary Information Classes for the Province of Nova Scotia are illustrated in Figure 3.4.2 and defined as follows (More complete descriptions are provided in Appendix D):

Client: Clients of the Province include both recipients of benefits and services, and other organizations with whom the Government does business. This includes individuals, companies and societies registered with the Province.

Program: The Province of Nova Scotia develops and operates programs for the benefit of its clients. These programs offer a wide range of benefits and services, such as family benefits, motor vehicle and driver licensing, business development, environmental protection, public safety, etc.

Organization: This class refers to the organizational units and internal workings of Government. This includes departments, boards, agencies, and commissions.

Financial: This class maintains information on all financial activities conducted by the Province. Though it may be considered a type of resource, financial information is of such a scope as to warrant a separate Information Class.

Resources: This Class defines the resources used by the Province to deliver programs to its clients. These resources include human resources, materials and information.

Facilities: Facilities are fixed resources of the Province including land and infrastructure such as roads, bridges and buildings.

Information Class Model

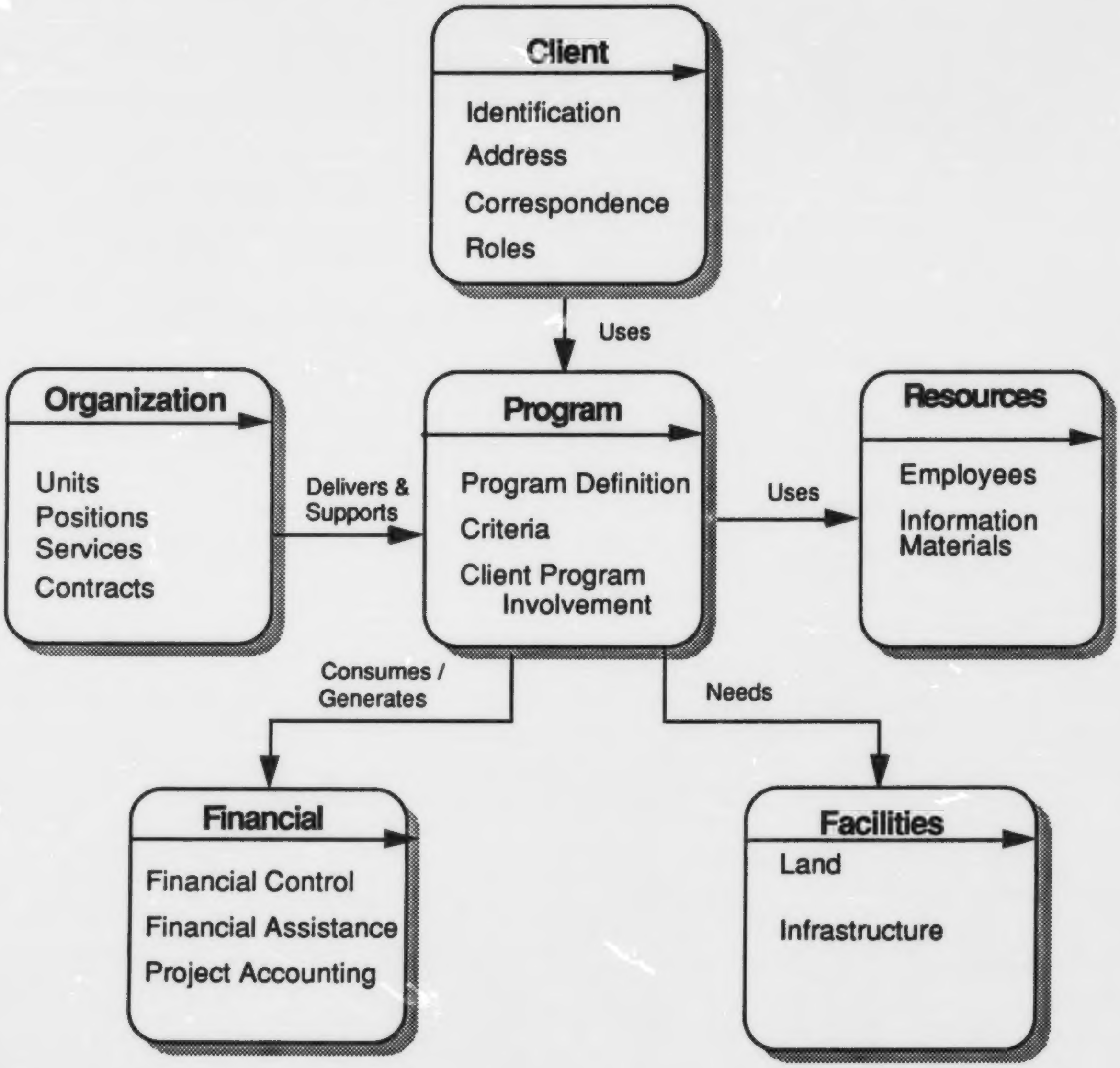

Client
Identification
Address
Correspondence
Roles
Uses
Organization
Units
Positions
Services
Contracts
Delivers & Supports
Program
Program Definition
Criteria
Client Program Involvement
Uses
Resources
Employees
Information Materials
Consumes / Generates
Needs
Financial
Financial Control
Financial Assistance
Project Accounting
Facilities
Land
Infrastructure

Figure 3.4.2

4.0 TECHNOLOGY ARCHITECTURE

The primary purpose of the Architecture Planning project is to define the Government-wide Technology Architecture and associated standards. The recommended Architecture is based on open systems standards and network computing.

As discussed in Section 2., open systems standards provide the means for system interconnectivity, resource sharing and vendor independence.

A network computing environment enables users to access a wide range of data, applications and computing resources without worrying about where they are or how they are interconnected. This environment utilizes the network, not the host/processor, to provide the physical and logical integration of components. The goal of network computing architectures is to make applications and information independent of the technology used.

The Client/Server model provides the basis for achieving technology independence and for partitioning applications for optimum resource utilization and performance. Clients and Servers are the fundamental building blocks of the architecture.

A Server is a provider of resources to one or more Clients in the architecture. It can be software, hardware or a combination of the two. One common type of server is a file server on a Local Area Network. Clients, on the other hand, request resources from servers. Like a Server, a Client can be software, hardware or a combination of the two. However a Client can also be a person using a Server to access computing resources. The network provides the connectivity between Clients and Servers.

As illustrated in the IT Architecture Overview, Figure 4.0, the technology architecture is comprised of four main components:

- workstations;
- local area networks (LAN's);

Government of Nova Scotia

Information Technology Architecture (Overview)

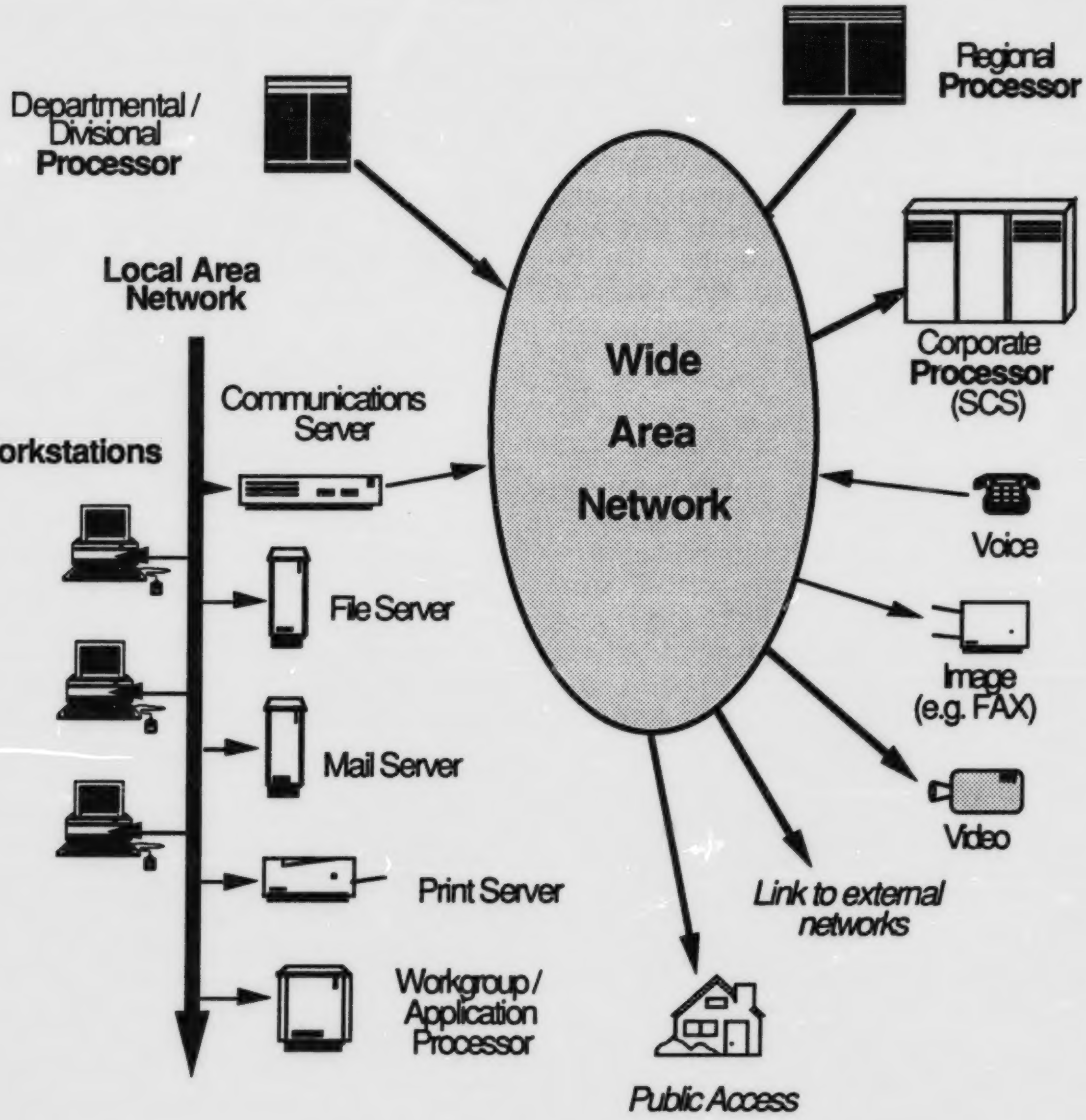

Departmental / Divisional Processor
Regional Processor
Local Area Network
Wide Area Network
Corporate Processor (SCS)
Communications Server
Workstations
Voice
File Server
Image (e.g. FAX)
Mail Server
Video
Print Server
Link to external networks
Workgroup / Application Processor
Public Access

Figure 4.0

- processors; and
- wide area networks (WAN's).

The standards for each component are defined to different levels of detail depending on the current situation, the maturity of standards in that area and on the need for standards within Government. In general, the recommended standards are based on open systems rather than on specific products. Where a product is identified, it is because the standards are not yet fully developed or because that product has become an accepted (i.e. de facto) standard in the market or in Government. In these situations, there is a still a stated direction towards open systems standards.

Each architecture working group established the standards for its portion of the architecture based on the following considerations:

- emerging industry standards;
- expert opinion/articles;
- market share/trends;
- conceptual analysis of options;
- current Government investment and satisfaction level; and
- experience and consensus within the work group.

No group carried out a detailed study of options, nor were there vendor discussions or demonstrations. Given the tight time constraints and limited resources, the working groups focused on those areas where standards were most urgently needed in Government. As such, further architecture standards work is required following the completion of this project.

The following sections describe the role, current situation, standards and guidelines and migration considerations for each component of the technology architecture.

4.1 Workstations

The intelligent workstation is the primary user interface in the proposed IT Architecture. The basic workstation is a personal computer comprised of a keyboard, monitor (screen), processing unit, main memory and optional disk storage. The workstation is capable of operating independently or as part of a network.

The intelligent workstation replaces "non-intelligent" terminals for most applications because of its ability to support the diverse and expanding requirements of users. The workstation places the processing power in the hands of the user thereby minimizing resource contention and optimizing performance.

The workstation is the platform of choice for personal applications (e.g. document processing, decision support and graphics), data capture, development tools and imaging (e.g. computer-aided drafting/design).
As well, it provides the user interface for applications on other platforms to which it is networked.

4.1.1 Workstations - Current Environment

In the Government today, there is a clear trend towards the use of intelligent workstations. At present, there are approximately 1730 intelligent workstations of different types and only 765 non-intelligent terminals. The installed base includes a variety of IBM-compatible PC's, Convergent Technology's CTOS workstations, Apple Macintoshes and specialized workstations. Over 60% of the units are IBM-compatible, 25% CTOS and 8% Macintosh.

Many of the current PC's are older technology and have limited capacity for growth. However, there is a recent trend towards 386-based workstations. The CTOS and Macintosh workstations are generally on Local Area Networks, but many of the PC's are standalone or provide terminal emulation to a host computer.

The main applications today for workstations are document processing, inquiry and decision support. So far, there is limited use at executive levels in Government, but there is a growing demand here as in other levels.

While there have been no established standards for microcomputers in Government, departments have tended to standardize based on their specific needs. The Departments of Transportation & Communications, Attorney General and Solicitor General utilize primarily CTOS workstations. The Department of Education has chosen Macintosh and all other departments use mainly IBM-compatibles.

The preferred application software varies with each workstation type. For the IBM-compatibles, the "de facto" standards are WordPerfect for word processing and Lotus for spreadsheets / decision support. There are no effective standards for other applications, although Harvard Business Graphics and dBase are widely used.

4.1.2 Workstation Standards and Guidelines

To gain the full benefits of a common IT Architecture across Government, it is important to agree on suitable standards for workstations, both hardware and software. Reasons for standardization of workstations include:

- ease of connectivity;
- capability to share data and applications and exchange formatted compound documents;
- simplified procurement, support, training and maintenance;
- interchangability of equipment and staff; and
- potential cost savings through volume purchasing.

Based on the anticipated users and applications, standards are proposed for three classes of workstations with provision for additional special options. The standard workstation classes are as follows:

- basic office workstation to serve most Government users;
- enhanced office workstation for advanced, specialized needs such as those of professional/technical staff and systems developers; and
- portable workstation for off-site requirements.

The chosen standards for each class of workstation and the suggested special options are shown in Figure 4.1.2. The recommendations are based on an evaluation of options with the following criteria:

- product and vendor market position and trends;
- existing installed and knowledgeable base in Government (i.e. hardware, software and expertise);
- ease of use (e.g. graphical user interface);
- availability of application software;
- ability to satisfy diverse Government requirements (e.g. office systems, LAN / host connectivity, local applications)
- performance, capacity for future requirements;
- choice of options (e.g. portable, lap-top, rugged); and
- choice of manufacturer/vendor - support options.

Workstation Standards

Hardware

Basic Office

Processor: 386 20MHz
Memory: 4MB
Monitor: VGA colour
Keyboard: IBM enhanced
Pointing: Track ball/mouse
Storage: 3 1/2" diskette or diskless
Comm: LAN attach

Enhanced Office

Processor: 386 xx or 486
Storage: Hard disk

Future

Scanner: Magnetic strip

Portable versions

Modem access to LAN / WAN
Ability to use full size monitor, keyboard ("docking")

Special options

Processor: Special function (e.g. engrg, RISC)
Monitor: Oversized screen,
Pointing: Touch screen
Scanner: Bar code
Plotting: Colour
Environment: Rugged

Software

Basic Configuration

Operating System: MS/DOS
User Interface: MS Windows
Word Processing: WordPerfect
Spreadsheet: Lotus
Graphics: To be determined

Options

End-user Database: To be determined

Figure 4.1.2

In summary, the MS/DOS workstation was chosen because of its suitability for the diverse requirements of Government, the large install base in Government and its predominance in the marketplace. The introduction of Microsoft Windows 3.0 has given the IBM-based products ease of use features previously available only on the Macintosh. The range of hardware options combined with the growing selection of application software and development tools support this choice.

IBM with OS/2 was not adopted as the standard at this stage because of its limited acceptance in the marketplace. Likewise, UNIX-based workstations are not yet a strong contender for general purpose use because of the lack of application software and relatively high cost. Macintosh, while rated very highly, is in limited use in Government and some of its traditional advantage is diminished by Windows. Although CTOS workstations are in wide use in Government, they are not mainstream and many of their advantages in workgroup computing and communications are now available through mainstream PC's and LAN's.

4.1.3 Workstation - Migration / Implementation Considerations

There are several issues which must be considered in preparing to implement the recommended workstation standards. These issues include:

- The **price of the standard configuration** is relatively high compared with available "low-end" models. The higher price is justified by the higher level of functionality, performance, ease of use and compatibility across Government. Hardware prices continue to decrease.

- **Few users currently have the standard configuration**. While some workstations (i.e. existing 386-base) can be upgraded, others may have to be phased out over time. There will be a need for detailed migration strategies for those departments which have adopted non-compatible standards.

- There is a need to **establish specifications for functionality, reliability and performance** to guide the procurement process. Of particular concern is the desirability to differentiate between brand-name equipment and clones for critical applications.

- **Locations with only one or two workstations** will not have a Local Area Network or processor. They will therefore require additional functionality at the workstation level to provide server and processor capabilities. Guidelines and standards must be developed for these additional features.

  Of particular concern is the need for a production application environment and database management system. The standard for such applications is ADABAS by Software AG (see Processor and System Development standards). Since this is not yet available under MS/DOS, there may be a need for a different application environment (e.g. dBase) or a different operating system (e.g. OS/2, UNIX) to deliver production applications on a workstation.

The activities required to implement the recommended workstation standards include the following:

- Select standard products for end user database and graphics. Considerations for the database are SQL compliance, ease of use, the requirement for data sharing, the ability to network and linking to ADABAS, the database on other platforms. The criteria for graphics include functionality, ease of use and integration with other software including WordPerfect and Lotus;

- Establish standard hardware and software test configurations;

- Establish training and support mechanisms;

- Initiate the transition to a common user interface, then to the graphical user interface for all applications;

- Institute a freeze on non-intelligent terminals and non-standard workstations;
- Determine the role for existing non-standard equipment (e.g. standalone applications, schools, hospitals, resale); and
- Initiate steps towards the proposed LAN-based environment (see next section).

4.2 Local Area Networks

Local area networks (LAN's) are the vital first link in Government data communications. LAN's are private networks of computing devices within a workgroup, building or campus and do not require access to regulated carrier facilities. In addition to providing high speed local communications, LAN's include basic file servers, print servers and an external communications gateway. LAN servers are also the preferred platform for such applications as:

- Electronic mail;
- Document storage and retrieval;
- Local inquiry and reporting on replicated databases; and
- Small, work-group specific database applications.

The basic LAN configuration is illustrated in the IT Architecture Overview, Figure 5.0. In some Government locations, there may be a need for multiple LAN's which can be bridged together so that they appear as one LAN to the user.

For architecture planning purposes, the local area network is comprised of 5 hardware and software elements as follows:

Hardware
- Cabling
- Topology
- Servers

Software
- Operating System
- Applications

LAN's will become an increasingly important component of the technology architecture. The driving forces for LAN's in Government are:

- to enable data sharing and communications within workgroups and beyond;
- to facilitate more cost-effective use of resources through device sharing; and
- to provide a controlled environment for managing distributed applications (including maintenance), data, and support (i.e. instead of standalone PC's).

4.2.1 LAN's - Current Environment

At present, the vast majority of local area networks (approximately 70) are CTOS workstation clusters in the Departments of Transportation, Attorney General and Solicitor General. The other LAN's include 6 Novell's, 2 IBM OS/2 LAN Servers, 1 Banyan-Vines and 2 Macintosh.

There is a growing demand for multi-functional local area networks in many departments. It is therefore critical to establish standards to avoid proliferation of various LAN's which would result in "islands of computing" in Government.

4.2.2 LAN's - Standards and Guidelines

The LAN operating system is one component of the architecture for which it is essential to establish a standard. The LAN is the hub of interoperability and interconnectivity, linking local users and giving workgroups access to the wide area network. Standardization is necessary to:

- ensure the required connectivity within workgroups and across Government;
- facilitate sharing of data, documents and applications;

- enable effective network management;
- facilitate development of the required technical expertise; and to
- simplify support and training in a complex network computing environment.

The recommended standards for each element of the LAN are depicted in Figure 4.2.2. The recommendations are based on an evaluation of options with the following criteria:

- Market considerations (e.g. market share, trends);
- Compliance with open architecture;
- Networking flexibility (e.g. mainframe, other networks);
- Security, integrity, fault tolerance;
- Capacity, expandability;
- Performance, reliability;
- Availability of application software;
- Ease of installation, ongoing support; and
- Vendor strength, commitment, support.

The Novell Netware 386 was chosen as the LAN operating system mainly because of the company's dominant market share, the proven capabilities of the base product and its strong functionality, capacity and reliability. Recent announcements linking IBM and Novell serve to strengthen the product's position for the future. Areas for concern include the lack of a true multi-tasking capability and the proprietary nature of the operating system. However, multi-tasking can be simulated on a single server or with multiple servers. Novell is moving towards "openness" and its market position ensures that other vendors will want compatibility with Novell.

Considering the current strong Novell positioning, the other LAN options did not have sufficient unique advantages to justify their selection for the broad LAN requirements of Government.

LAN Standards

Hardware

Cabling:	Unshielded twisted pair
Topology:	IEEE 802.3 (e.g. Ethernet) for small-med networks (<50 devices) or 802.5 (Token ring) for larger networks
Printers:	Laser, impact (optional)
Storage:	LAN disk LAN tape drive Optical disk (e.g. CD ROM, WORM)
Communications:	WAN, FAX
Other:	Scanner for paper documents UPS, Facilities management

Software

Basic Configuration	
N/W Operating System:	Novell Netware 386
Electronic Mail:	TBD (X.400 message transfer standard, X.500 directory standard)
Workgroup Productivity Tools (Calendaring):	To be determined
Data Transfer:	NATURAL Connection
Options	
End-user Database (data server):	To be determined

Figure 4.2.2

4.2.3 LAN - Migration / Implementation Considerations

The issues which must be considered in preparing to implement the recommended LAN standards include:

- There are **no existing Government installations** of the standard configuration;
- There is also a **lack of expertise/support** within Government for the proposed LAN environment; and
- Some of the desired **functions are not yet available**, but are promised in future releases of the software.
- Given the current limited knowledge/experience in the proposed LAN environment, it is essential that the implementation plan include a **solid technology trial**.

The following are among the LAN implementation activities:

- Establish management framework and resources for action plan and ongoing support;
- Select standard software packages for E-mail (in conjunction with the wide area network) and workgroup productivity tools (e.g. Calendaring/Scheduling)
- Define pilot(s) for LAN
  Criteria:
    - low risk
    - support of Strategic Drivers
    - workgroup/departmental
    - applicability across departments
- Define detailed requirements and specifications for all elements of LAN;
- Implement pilot / evaluate results; and
- Develop overall LAN implementation strategy.

4.3 Processors

Processors are the primary technology platform for delivering transaction processing applications and for maintaining shared Government databases. In the proposed architecture, processors are not the platform of choice for personal /workgroup productivity tools. For architectural planning purposes, the term "processor" refers more to the use of the technology rather than to the type. As such, a processor may be a mainframe, minicomputer or microcomputer. It is distinguished from a workstation in that it serves multiple users and from a LAN server because it is multifunctional and can operate independently of the LAN.

A processor is comprised of hardware (e.g. input/output devices, storage devices, processing unit) and software (e.g. operating system, database management system, communications monitor, security monitor).

4.3.1 Processors - Current Environment

The Nova Scotia Government currently utilizes a wide variety of processors. The central computing facility within the Department of Government Services consists of an IBM 3090 with the MVS operating system and the Software AG development environment, ADABAS/NATURAL. Over 1600 workstations are connected to the Government host and many more can communicate on an ad hoc basis.

A second major processor with Government-wide access is an HP 3000 in the Department of Finance. This processor uses HP's proprietary MPE XL operating system and the COGNOS development environment, PowerHouse.

Several other processors exist in various departments, each with its own proprietary hardware and software (e.g. Digital, Data General and IBM minicomputers).

Historically, the majority of applications have been developed for corporate mainframes. Other processors have only been considered on an exception basis.

4.3.2 Standards and Guidelines

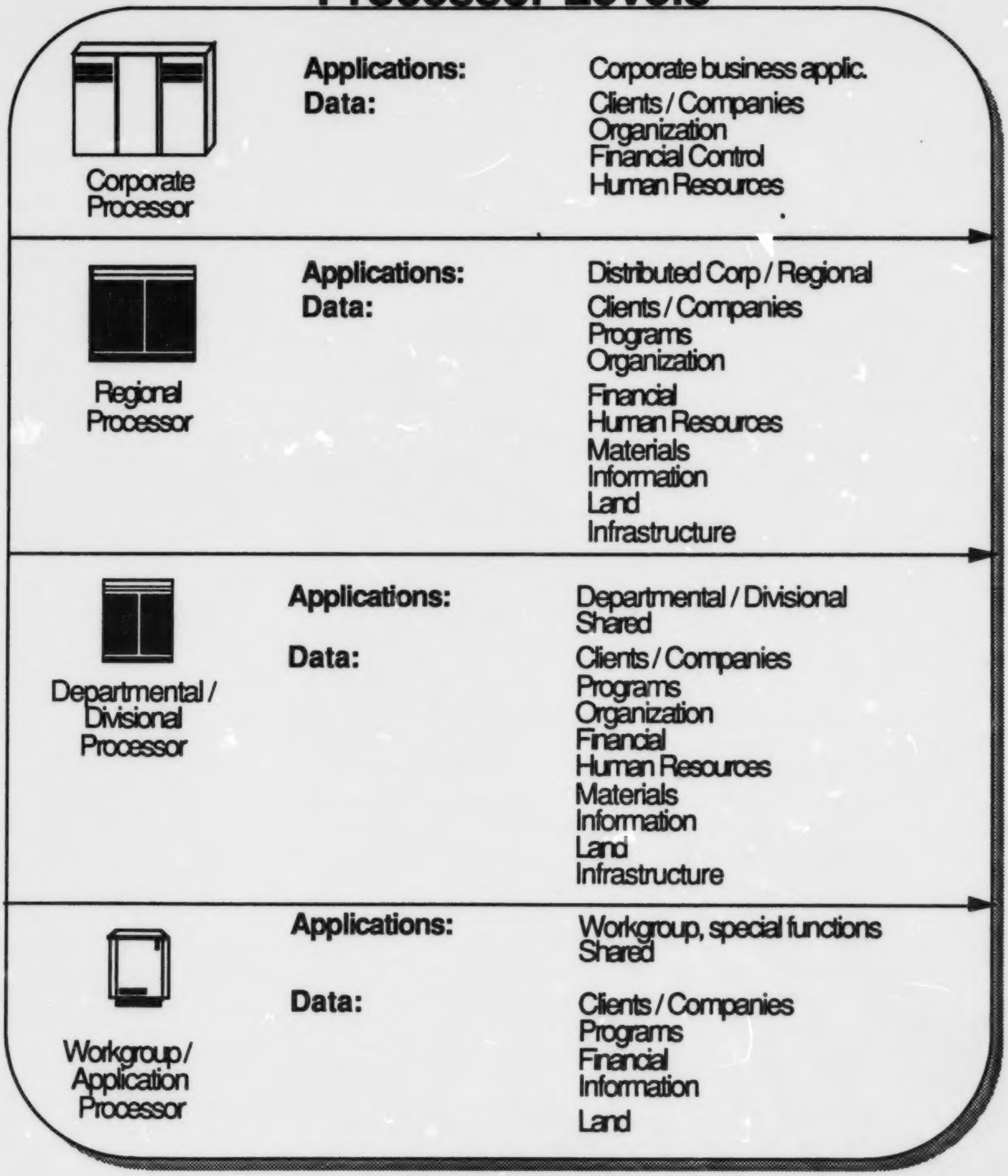
There is a requirement for standardization of processor environments. The following are the key reasons for standardization:

- to promote portability of both applications and skills;
- to ease interface requirements; and
- to simplify support and maintenance;
- to facilitate training; and
- to reduce procurement costs through leveraged buying.

In recognition of the Architecture Principle that "Processing, storage, communication and workstation technologies must be placed at multiple levels ... in accordance with dispersed business operations", four standard levels of processors are identified in the IT architecture:

- **Corporate Processor(s)** which serves as the host for corporate applications and databases;
- **Regional Processors** which support multiple departments for regional applications and/or distributed corporate applications; (There are currently no regional processors in Government.)
- **Departmental/Divisional Processors** which provide multiple applications to an individual department or division; and

Processor Levels



Corporate Processor

Applications: Corporate business applic.

Data:
Clients / Companies
Organization
Financial Control
Human Resources

Regional Processor

Applications: Distributed Corp / Regional

Data:
Clients / Companies
Programs
Organization
Financial
Human Resources
Materials
Information
Land
Infrastructure

Departmental / Divisional Processor

Applications: Departmental / Divisional Shared

Data:
Clients / Companies
Programs
Organization
Financial
Human Resources
Materials
Information
Land
Infrastructure

Workgroup / Application Processor

Applications: Workgroup, special functions Shared

Data:
Clients / Companies
Programs
Financial
Information
Land

Figure 4.3.2-A

- **Workgroup/Application Processors** which serve the application needs of a particular workgroup and/or provide a single, often specialized, application to a broad community of users.

These processor levels are further described in Figure 4.3.2A.

In general, the trend in Government will be towards greater distribution of applications away from the Corporate mainframe and to a larger number of specialized application servers, often closer to the user community. The mainframe will continue as the primary server for Corporate applications and databases. Application functions will be partitioned across multiple platforms on a client/server relationship. For example, the transaction processing and database may reside on one processor, the user interface on the workstation and the printing on a third platform (i.e. server).

The choice of processor level for a particular application is determined by several factors such as:

- requirements for data sharing;
- service to the public;
- industry standards/trends;
- business functions supported;
- business location;
- application complexity;
- volume and performance considerations;
- support staff availability;
- data integrity considerations;
- backup and recovery issues;
- confidentiality and security;
- system integration requirements;
- operating and development costs; and
- economic development considerations.

Two related architectural principles state that "the delivery of cost-effective quality service to clients will be the primary factor in determining where applications (and information) reside".

In keeping with the Architecture Principles and the industry trends described in "Strategies for Open Systems", the Province has selected the Open Systems standards as a direction for all processor levels. The standards are centred around compliance with POSIX ("*Portable Operating System for Computer Environments: An IEEE standard operating system interface...*". The associated characteristics and standards are summarized in Figure 4.3.2B.

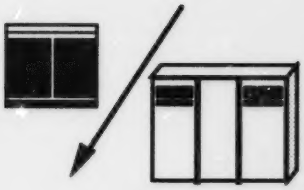
The key rationale for standardizing on open systems include:

- it is the emerging set of standards and is being adopted by virtually all major vendors and standards organizations;
- vendor independence/improved purchasing position;
- portability of applications and databases;
- improved lifespan of solutions - reduced likelihood of obsolescence;
- growing availability of cost-effective system components and solutions; and
- enhanced flexibility in placing applications across the full range of platforms.

4.3.5 Processors - Migration/Implementation Considerations

As with workstations and LAN's, there are several issues to be addressed in planning the migration towards the processor standards. These include:

- Not all POSIX standards are yet available and conversely existing products are not fully compliant. In these cases, decisions must be made according to the general thrust towards open architectures and the stated product direction.
- Existing Government processors do not comply with the standards. The need for coexistence with current environments must be addressed in the migration strategy.



Processor Standards

Characteristics

Hardware:	RISC-based architectures
Software:	Full POSIX compliance
Communications:	OSI compliance

Standards

Operating System	
Corporate Processor:	MVS / "UNIX" (POSIX compliant)
Other processors:	"UNIX"
Database Management System:	ADABAS
Development Environment:	NATURAL SQL Ad hoc Query facility

Figure 4.3.2-B

- There is a current lack of expertise/support for the target technical environment and client/server architecture (e.g. workstation-based graphical user interface). Training and support is a key element of the migration.

- The migration strategy must take into account the ongoing requirement for non-standard package solutions where there is no cost-effective compliant solution available.

- Unlike other components of the architecture, there are no urgent demands for decisions and actions with processors. Each situation can be handled as requirements change within the context of the available options and chosen standards

The action plan for processors includes the following steps:

- Promote connectivity of existing processors as a short term focus;

- Minimize investment in non-standard platforms;

- Develop bridging and hybrid solutions in the midterm; and

- Initiate a program to replace non-standard processors in conjunction with major system changes / upgrades.

4.4 Wide Area Network

The Wide Area Network (WAN) is at the centre of the Information Technology Architecture, serving as the "electronic communications highway" that links the Province. The WAN is defined as "an intelligent transport and distribution mechanism for interconnecting voice, data and image devices over a wide geographic area." For architecture planning purposes, the WAN covers all communications which require the use of regulated carrier facilities (i.e. outside a building or campus) as well as the gateways to local area networks (LAN's) and to external networks.

The role of the wide area network is to provide the required communications between all Government locations, users and devices across the Province. It must also provide for access from the public and other organizations.

While data communications is the primary focus of this Architecture plan, consideration is given to voice and video communications because of the potential opportunities for shared transport and future integrated applications.

4.4.1 WAN - Current Environment

The current Provincial data network is designed to support host-based communications between terminals (or PC's emulating terminals) and the IBM mainframe or the Department of Finance HP minicomputer. There are nodes throughout the Province with multiplexors that allow users to attach to either host and provide for shared transport. The current network primarily supports IBM's Systems Network Architecture (SNA).

In addition to the Provincial data network, several departments utilize point-to-point communications for specific host-based applications and for communicating between computers. There are pressures from departments for expanded networks to support distributed applications and databases A primary concern in the WAN strategy is to avoid the proliferation of technology islands across Government.

The voice network utilizes Central Office Switching through DMS facilities at MT&T. The network incorporates WATS lines for more cost-effective service. Recent studies indicate that there is an immediate opportunity to further reduce voice communication costs by 10-15% by sharing the backbone data network.

4.4.2 Network Services

A conceptual model of the proposed wide area network is shown in Figure 4.4.2. The proposed WAN has built-in intelligence to provide four types of services:

1. Access services

   The WAN must facilitate access across all work locations, users and devices in the architecture.

Wide Area Network
(Conceptual Model)

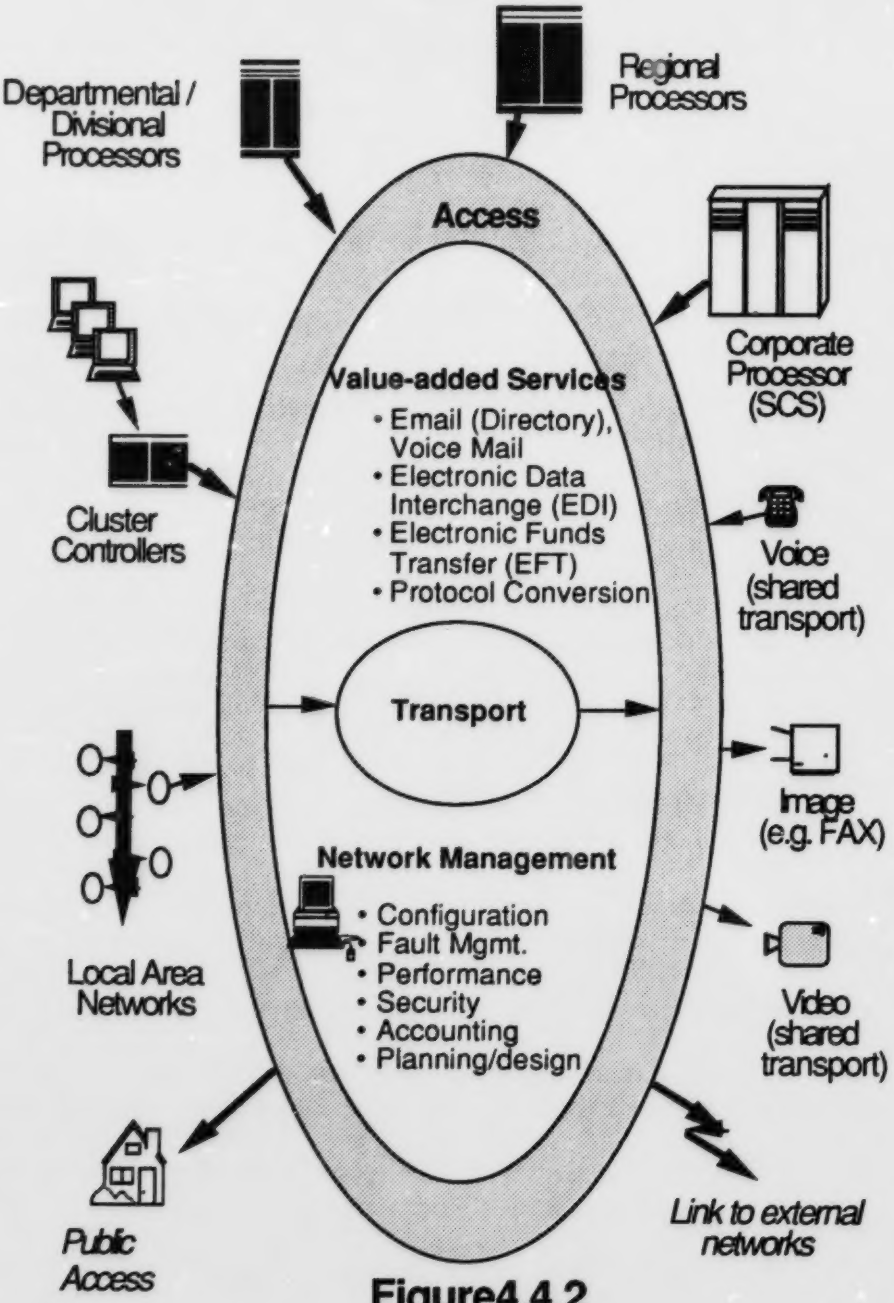

Departmental / Divisional Processors
Regional Processors
Access
Corporate Processor (SCS)
Value-added Services
• Email (Directory), Voice Mail
• Electronic Data Interchange (EDI)
• Electronic Funds Transfer (EFT)
• Protocol Conversion
Cluster Controllers
Voice (shared transport)
Transport
Image (e.g. FAX)
Network Management
• Configuration
• Fault Mgmt.
• Performance
• Security
• Accounting
• Planning/design
Local Area Networks
Video (shared transport)
Public Access
Link to external networks

Figure4.4.2

2. Transport services

The network must provide transport services by utilizing the best combination of available options to ensure the most cost-effective and flexible service throughout the Province.

3. Network Management Services

An advanced network management facility will be required to effectively manage the WAN. The facility must address the following functional areas:

- Configuration Management to manipulate network configurations to adapt to the changing needs and traffic patterns or to isolate problems;
- Fault Management to detect problems and maintain network availability at an acceptable level;
- Performance Management to ensure adequate service levels and identify and correct potential problems before they cause a fault;
- Security Management to control access, authorization and partitioning of the network;
- Accounting Management to monitor usage and provide information for cost control and regulation; and
- Planning and Design Management to plan new network facilities or extend or optimize existing ones.

4. Value-added services

The WAN will also provide a range of services to users of the network. Examples of value-added services include:

- Government-wide Electronic Mail (i.e. directory and message transfer facilities) and Voice Mail;

- A common Electronic Data Interchange (EDI) facility for "batch" communication within Government and with external organizations;
- Access to a common Electronic Funds Transfer (EFT) service for handling financial transactions; and
- Protocol Conversion to accommodate a variety of access and communication requirements.

4.4.3 Guidelines and Standards

The wide area network must be planned within a framework of guidelines which include:

- **universal network access** to Government and public users;
- **peer-to-peer connectivity** between all workstations and processors (i.e. without host control);
- provision of differing **levels of service according to need**, proximity and cost;
- support for **multi-functional** (cross-department) **applications;**
- support for a **multi-vendor processor environment**;
- support of the **current environment (SNA)**; and
- **availability of technology and standards**.

The wide area network architecture will adopt the Open Systems Interconnect (OSI) standards. OSI is defined by the International Standards Organization as a seven-layer model of a network architecture, with each layer performing a distinct function. It defines the accepted international standards by which "open systems" should communicate with each other, and also defines the rules for how these standards are implemented. The term "open system" is used to describe a computing system or network that can interoperate with any other open system based on the OSI standards.

Figure 4.4.3 summarizes the characteristics and standards of the recommended wide area network architecture.

4.4.4 WAN - Migration / Implementation Considerations

As the heart of the IT Architecture, the wide area network must be a priority in the overall migration strategy. The following are the key management and operational issues to be addressed:

- **The need for a proactive approach**
  To date, the wide area network has been provisioned to meet specific requirements for connectivity, typically point-to-point between two locations, or connecting terminals to a host. To meet the varied and growing communications needs of Government will require a more proactive approach, with up front investment in network infrastructure. Otherwise, no single project or department could bear the full implementation costs. This approach will likely involve one or more pilot projects to drive the WAN development.

- **Evolve with technology**
  Neither the OSI standards nor the supporting technology is fully developed today. However, this is an area of rapid technological advancement. Government should evolve the wide area network to take advantage of new developments as they become proven and cost-effective.

- **Management control**
  The wide area network must be considered as a corporate resource requiring central management direction and control. However to ensure the network effectively serves its clients, there must be active departmental involvement at all stages. In particular, departments must be given the opportunity to manage their respective portions of the network (e.g. device configurations, security, etc.).

WAN Standards

Characteristics

Distributed architecture
- Regional nodes

Designed for required levels of service
- Local / Metropolitan
- Regional
- Provincial
- External / Public

Integration
- Data, text, voice, image
  - Initially shared transport
  - Ultimately integrated applications

Flexibility
- Bandwidth on demand
- Support communications between all work locations
- Support communications between all processors, servers, LAN's
- External WAN's

Standards

Architecture:	Open Systems Interconnect (OSI) (SNA Coexistence)
Data Transport:	X.25
Message Transfer (Email):	X.400
Directory:	X.500
EDI/EFT:	ANSI/X.12

Figure 4.4.3

- **Location independent**
  As a key enabler of service delivery, the wide area network must be equally accessible without penalty from any location in the Province.

- **Commitment to service**
  The WAN must be operated on the basis of providing agreed level of service to its clients, economically.

- **Cost allocation considerations**
  Like any component of infrastructure, there must be an equitable means of distributing costs among the user communities. To encourage effective use of this resource, is recommended that cost allocation be based on access and bandwidth (capacity) rather than on usage. Other mechanisms can be employed to discourage abuse.

- **Coordinated planning**
  WAN planning must be integrated with overall IT planning both Government-wide and within departments. (e.g. strategy, architecture, applications and technology planning)

- **Consideration of other networks**
  The migration planning for the wide area network must consider the potential role of other Government network initiatives such as the proposed College l'Acadie network for distance education.

The following are several of the key action items that make up the implementation plan for the wide area network:

- Establish management framework and resources for action plan;

- Identify pilot applications for voice and data;
  (Consider proposals from departments)

  Criteria:
  - low risk
  - support of Strategic Drivers (economic benefits)
  - applicability across departments
  - scalability
  - cross-government vs departmental

Candidates:
- voice mail
- Electronic mail (Email)
- Community Colleges
- Departmental operations, budget, Email
- Halifax metro network
- integration of voice/data

- Define requirements for WAN;
- Develop specifications for WAN (i.e. design);
- Define ongoing organization and management structure; and
- Develop an overall implementation plan.

4.5 Standard Development Environment

System quality and productivity can be measured by user satisfaction, project cost-effectiveness and timeliness, and system reliability and maintainability. There are four primary factors that impact the quality and productivity of a systems development project:

- the experience and motivation of the team members;
- the experience and motivation of the users;
- the soundness of the project planning, organization, leadership and control; and
- a development environment characterized by an effective method, appropriate techniques and productive tools.

This section deals with the Government-wide implementation of a standard approach for the latter two factors. It introduces the concept of a standard development environment, including project management, for the Government, and then establishes directions for the individual components of the environment. Implementation issues and migration considerations are also addressed.

4.5.1 Standard Development Environment Overview

The development environment is the integration of a method, standards, development tools and common techniques covering the development cycle, with the aim of designing and building information systems. The productivity of the development environment depends not only on the effectiveness of each of its parts, but also on the quality of their integration.

A diagram depicting the development environment components and integration is presented as Figure 4.5.1 on the next page. The key components are as follows:

- **Methods:** Work-breakdown guidelines specifying the work to be done and the end products or deliverables to be produced in consistent, productive systems development.

- **Techniques:** Specific approaches for developing deliverables (e.g.. data modeling, joint application design workshops, etc.).

- **Tools:** Aids to support and facilitate the development of deliverables (e.g.. 4th generation language, computer assisted software engineering, etc.).

- **Standards:** Established rules or parameters that pre-define acceptable methods, techniques, tools and deliverables.

Government-wide implementation of a standard development environment will result in:

- ease and cost-effective training and support of staff;

- pre-defined, measurable and comparable results;

- consistent and uniform standards;

- improved management of development resources;

- improved flexibility in staffing development projects;

- reusability of deliverables; and

- improved systems quality and productivity.

Standard Development Environment

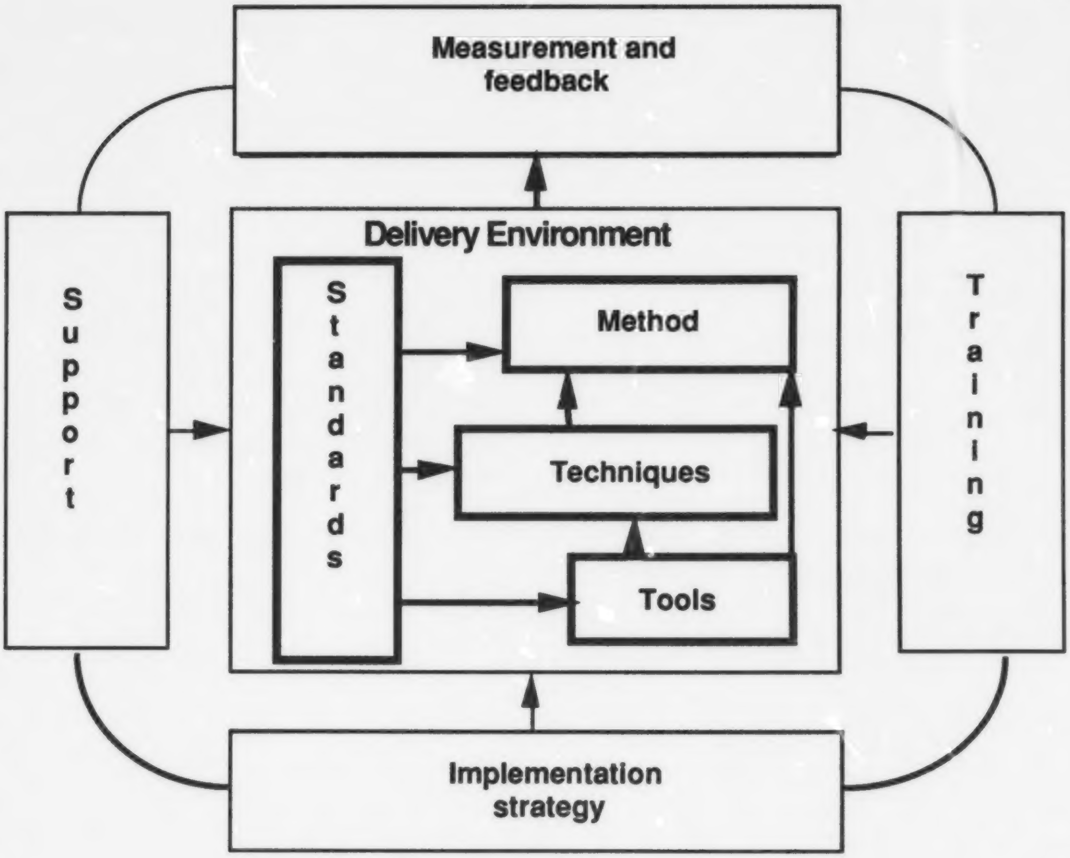

Measurement and feedback
Delivery Environment
Standards
Method
Techniques
Tools
Support
Training
Implementation strategy

Figure 4.5.1

4.5.2 Systems Development Methodology

The cornerstone of a standard development environment is a sound system development methodology. A suitable methodology must:

- provide a structured and disciplined approach to systems development;
- be flexible and adaptable;
- be independent of technology and the type of systems development delivery;
- be supported by ongoing training and support;
- provide a management focus;
- utilize modern development tools and techniques; and
- clearly define roles and responsibilities of participants.

Implementation of a common systems development methodology across Government will require:

- senior management support;
- clearly defined roles and responsibilities;
- commitment to an implementation strategy;
- consistent architectures for information and applications;
- an education and training plan;
- provision for coaching and support; and
- an approach for adopting the methodology for maintaining existing systems.

The benefits of Government-wide implementation of a systems development methodology stem from the consistency of approach, the productivity of the projects and the quality of the deliverables. The DMR Productivity Plus™

development methodology has been chosen by the Department of Government Services following a competitive selection process and an extensive product trial. **It is recommended that this methodology be implemented on a Government-wide basis.**

4.5.3 Development Tools and Techniques

In keeping with the Architecture Principle to locate applications as close as possible to the end-user, **it is recommended that the Government implement a standard systems development workbench**. The developers workbench concept is the use of an application server and workstation technologies to support an integrated suite of development tools. The workbench is centred around the repository and linked to the standard technology platforms. By providing developers with effective tools, instantaneous response time and rapid turnaround on compiles and tests, overall productivity and job satisfaction would be greatly enhanced.

Development tools and techniques must be implemented hand in hand. A wide variety of tools and techniques have been identified according to the specific development phase which they support. Examples of tools and techniques requiring standardization in the development environment include the following:

Phase	Techniques	Tools
Definition/Analysis	Systems Analysis Modeling	Modeling Tools Repository
Design/Construction	Physical Modeling Prototyping	Languages DBMS
Implementation	Testing Quality control	Software Promotion Test Data Generators
Maintenance	Re-engineering	Documentation Software

Given the current substantial investment in applications, **it is recommended that the Government use and support the Software AG systems development environment for professional applications development.**

Recommendations and standards for other development tools will be determined during the planning and implementation of the standard development environment.

4.5.4 Project Management and Reporting

Project management is the process of planning, organizing, controlling and leading system development project teams to deliver quality systems in a productive manner. A standard Government-wide project management approach will provide for consistent project reporting, improved management control, improved productivity, a management focus and accountability.

The Productivity Plus™ systems development methodology includes an integrated project management approach. **It is recommended that this approach be implemented in conjunction with the implementation of Productivity Plus™.**

To complement the common project management approach, the Government should implement a Government-wide project reporting approach that includes:

- identification of all costs associated with development of a project;
- interim reports on a pre-defined basis for estimates versus actual; and
- a final report including a post-appraisal and estimates versus actuals.

Reporting would be targeted at the appropriate level, (e.g. project steering committee, project departmental management, or EDPAC) depending on the size and nature of the project.

Implementation of a common project management and reporting approach will require:

- a common estimating technique;
- a standard process for cost identification;
- a standard resource utilization measurement process;
- consistent reporting standards;
- commitment to post appraisal;
- support and commitment to the approach by all levels of the organization; and
- access to appropriate tools and techniques.

4.5.5 Migration Considerations

The primary migration recommendations are for the establishment of an Implementation Steering Committee and a Development Standards Committee. The role of the Implementation Steering Committee would be:

- To plan and direct the Government-wide implementation of the standard development environment;
- Responsibility for the ongoing evaluation, establishment and maintenance of development environment standards;
- Cross-departmental representation; and
- Government-wide mandate.

5.0 APPLYING THE IT ARCHITECTURE

The Information Technology Architecture defined in Section 5.0 enables innovative and more effective methods for Government to conduct its business and to better serve its clients. This section illustrates how IT can be applied in the various work locations (i.e. Distributed Computing Environments) and presents examples of new ways of doing business (i.e. Business Scenarios).

5.1 Distributed Computing Environments

The proposed network computing architecture is designed to support distributed business functions by placing applications, information and technology in the hands of the users who need them, where they need them. As previously discussed, the deciding criteria is cost-effective service to clients. Appendix D describes each of the proposed work locations in terms of:

- business functions;
- user classes;
- generic applications;
- information classes (access requirements); and
- technology requirements.

5.2 Business Scenarios

This section presents future scenarios in which the Province of Nova Scotia applies Information Technology in its business. Each scenario suggests how technology can be used to transform administrative processes or enable improved and innovative service delivery. These scenarios illustrate the role of each component of the IT Architecture, namely information, common applications, work organization and technology (i.e. workstations, LAN's, processors and the WAN).

The scenarios focus on the business activities performed at five proposed work locations:

- Mobile Employee;
- Self Service Location;
- Client Location;
- Company Location; and
- Employee at Home.

Mobile Employee Scenario

A "Mobile Employee" refers to any Government employee who performs a portion of his/her work away from a fixed location. This may be in various Government facilities or off site locations. Three examples of a mobile employee follow.

Example 1

Services such as social assistance are delivered by case workers across the Province who make regular client visits. Client master files are held in a central database from which a worker can "download" a subset of files for the particular clients they will be visiting over a period of time. The files would be downloaded at a fixed location (office, home, third party location) to a portable computer. The files can then be referenced and updated (if required) at the client site and then later "uploaded" if necessary. The workers would also have access to facilities such as electronic mail and inquiry through a dial-up telephone line to the central computer.

Example 2

Mobile employees who currently work in locations such as building sites and the outdoors (e.g. Transportation, Lands & Forests), in managerial and technical capacities can use portable or hand-held computers to support their work. These may used in either standalone mode or in conjunction with data that has been downloaded from a central database. Supporting application programs facilitate such tasks as building design (CAD), geographical/resource surveying and access to licensing and permit information. The work results (e.g. survey data) could be uploaded to the central computer as required. The workers would also have access to electronic mail and inquiry through a dial-up telephone line to the central computer.

Technology Employed

Mobile Employees would require portable computers, secure communications with remote access along with supporting applications and associated training.

Impact on Clients

- Improved service quality - more responsive, faster turnaround, and fewer errors.

Impact on Government

- Increased productivity of field workers - more time for clients instead of on paperwork and in the office;
- Reduction in administrative workload at other work locations such as service delivery points/regional office/head office; This translated into significant reductions in management layers and administrative support.
- Capability to contact mobile employees by electronic mail, eliminating problems with telephone tag; and

Self-Service Location Scenario

A 'Self Service Location' is an unstaffed facility that provides access to Government services and information. This requires highly functional, user-friendly technology to provide a simple but comprehensive interface to the public. This type of public-access delivery is often housed in what is commonly referred to as a 'kiosk'. These kiosks would normally be located in public locations such as shopping malls and would mirror the type of secure and convenient access provided by the banks' automated teller machines (ATM's) that the general public has come to trust. Like the ATM's, the

Government kiosks would complement, not eliminate other delivery mechanisms.

The self service kiosk would be appropriate for providing a wide range of services to the public, such as:

- access to company profile and product information;
- access to property assessment and deed registration information;
- information on Government programs and eligibility requirements;
- access to tourist information, provincial maps, government publications and other reference material;
- access to Government legislation, policies, and procedures;
- access to vital statistics information;
- access to the Civil Service Commission job opportunities board;
- applying for and/or checking the status of such Government programs as student loans, home improvement grants, farm loans, fishery loans, etc.;
- renewing permits, registrations, or licenses, including credit card payments (requires special printers or subsequent mailing of documents);
- updating appropriate personal information such as address, family status, etc.; and
- booking public resources or facilities.

Technology Employed

The self service kiosk would utilize a number of recent advances in technology. A specialized workstation capable of accepting a Government ID card or a charge card would be necessary to ensure appropriate security could be maintained. Touch screen technology would greatly enhance the public interface, as would the implementation of multi-media applications capable of mixing text, graphics, voice and video features. Special printers are required to provide copies of requested information and/or to print custom documents. These technologies are being applied in other jurisdictions (e.g. State of Hawaii) and are being met with great enthusiasm.

Impact on Clients

- improved public access to services (kiosks could be available 24 hours a day depending upon their physical location);
- improved awareness and understanding of Government programs; and
- improved quality of service.

Impact on Government

- increased visibility; Government would be seen as progressive by expanding the service hours and by demonstrating how this approach impacts favorably on the bottom line.
- potential staff savings by providing unattended services and eliminating much of the related paperwork; manual servicing of information requests could be generally reduced.
- payments received in these kiosks could enable direct deposits into Government accounts, which could generate increased financial benefits;
- facilities costs; The kiosks and the workstations themselves might require up-front capital expenditures at each location and require a modest operational budget. However there would be opportunities to form alliances with the business community to offset some of these costs.
- applications requirements; The applications required to provide the public interface to these services need to be built as a front-end to existing and planned applications. The implementation of any Government-wide (corporate) information databases would be a pre-requisite.

- expanded network service and hours of operation would impact on the current service delivery provided by the Provincial network and mainframe; this may require additional staffing to operate.

Client (Individual) Location Scenario

A Client Location is defined as any point of electronic data communication access to Government by a private citizen. This would generally mean a private home or place of work. The potential modes of communication would be a digital telephone and/or a personal computer with a modem.

The potential opportunities and impacts are similar to the Self-Service Location described above except for the limits imposed by the client's technology.

Company Location Scenario

This scenario applies to any company (e.g. supplier or agent) doing business with the Government of Nova Scotia.

As a part of conducting day-to-day business, companies would be given direct access to a range of Government information and applications. including contract information, billing, accounts payable/receivable transactions and general inquiries. Government would also have access to Companies' systems for product/service information, placing orders and followup on deliveries. It would also be advantageous for Government and companies to have electronic mail capability.

Technology Employed

The nature of the communications would be online for some activities (e.g. inquiry) and batch (through Electronic Data Interchange for typical business transactions (e.g. purchase orders, invoices). Network security is vital. A company would need a processor and/or intelligent workstation to access the Government network.

Impact on Clients

- improved access / opportunities for Government business; and
- streamlined transaction processing - reduced administrative costs.

Impact on Government

- promotes contracting out and fosters economic activity;
- improved delivery of services - quality and timeliness; and
- reduced administrative costs - overhead, data entry/clerical work (opportunity for HR reallocation and/or down sizing).

Employee at Home Scenario

The Employee Working at Home scenario is a situation that will become more popular and feasible in the future. Through technology, a government employee is capable of performing a significant portion of his/her job activities from home. This form of work has been referred to as "electronic commuting". Examples of work that could be performed from home include:

- Telephone service delivery - where the employee provides over-the-telephone services to clients, supported by direct access to databases, "expert systems" and electronic mail across the wide area network;
- Central Database Updating - an employee who is on the road during the day, returns to his/her home (instead of travelling to the office), updates computer databases with the results of the day's work and retrieves the next day's schedule;
- Systems Development - the function of developing computer programs. Once the high level analysis and design of a system has been completed, the programming, testing, and general maintenance can be carried out at home.

Technology Employed

- Intelligent workstation;
- access to wide area network; and
- supporting applications, databases and expert systems.

Impact on Clients

- improved service, especially during peak periods; and
- better access to service, especially in remote locations.

Impact on Government

- ability to provide consistent quality of service throughout the Province, without additional costs;
- increased flexibility in scheduling work to maintain service levels, especially for peak periods;
- cost savings (space, facilities);
- employee satisfaction through increased flexible work arrangements - could lead to improved productivity;
- travel time reduced - less traffic, less congestion in urban centres, (on a wide scale, this option could reduce overall transportation costs); and
- requires control systems to ensure employee is meeting commitments and that the quality of work remains high.

5.3 Common Applications Opportunities

One of the key benefits of establishing a common architecture is to facilitate opportunities for common applications and data. These opportunities fall into four categories:

- **Corporate:** An opportunity is corporate if both the applications and data can be shared across departments and it is 'owned' by a central agency (e.g. HRMS - Human Resources Management System).
- **Shared:** An opportunity is shared if the applications and data can be shared across departments but it is 'owned' by one primary line department (e.g. JOIS - Justice Oriented Information System).
- **Decentralized:** An opportunity is decentralized if the applications can be used across departments but the data is not shared and the ownership may also be distributed (e.g. departmental component of the Budget System).
- **Common Components:** An opportunity having common application components only (e.g. cheque writer).

The remainder of this section describes eleven potential opportunities for sharing common data and applications. These opportunities are not a comprehensive list, but are given as examples in no specific order.

Companies Profile (Corporate): Numerous departments within government as well as many external organizations need access to information on companies. In many cases, several different departments are dealing with the same company and each has its own database. There is an opportunity for departments to share basic company data and improve service while eliminating the redundant effort and errors involved in maintaining multiple databases.

Client (Corporate): All departments within government store information about their clients. Different departments dealing with the same people all maintain their own records. Some of the larger Client databases in Government include the Registry of Motor Vehicles records, MSI, Vital Statistics and Community Services. There are numerous other client files in other departments.

There is a opportunity to share basic client data (e.g. name, address, identification number) and the applications that maintain it. Because of the sensitive nature of this opportunity, there must be restrictions on the information available to each department. Specific program data would continue to be maintained in separate related databases. Like the Companies Profile, a common Client profile would improve service while eliminating the redundant effort and errors involved in maintaining multiple databases.

Stationery Stockroom (Corporate): The Central Stationery Stockroom is used by all departments within government. It handles the receiving, issuing and storage of government stationery items. Each department holds a smaller inventory to handle day-to-day stationery requests. The departmental inventory is stocked from the central government stockroom. There is an opportunity to streamline administration and cut inventory costs by using a Corporate system with departmental access to manage the central stockroom and supply the departments.

Fixed Asset Inventory (Decentralized): All departments within government have a requirement for a fixed asset system. Although the assets vary from department to department, the functions are similar and there is a requirement for Government Services to roll up all fixed assets across government. There is therefore an opportunity for a common application across all departments with the capability for departments to share data with Government Services.

Manufacturers/Products (Shared): Many government departments and clients (companies) need to access information on Nova Scotia manufacturers and their products. The information may come from both internal and external databases and even optical storage catalogues. This system should make use of the Companies Profile database described above. To remain current, accurate and useful, the information must be updated from a number of sources, including the companies themselves. This opportunity may have significant economic advantages for the Province.

Library (Decentralized): Most Government departments have a library of one form or another. There is a growing need to automate the functions of the library, in particular the cataloguing and circulation of departmental collections. Although contents of each library may be largely unique, there are advantages to linking all libraries within government to facilitate inter-library loans and reduce overall costs. As a minimum, a common or shared system would reduce costs associated with implementing independent solutions across Government.

GIS Base Maps (Corporate): Numerous departments within government, as well as external organizations and individuals, need access to information relating to the land and water resources across the Province. The same base maps are required by all departments who in turn layer their data (e.g. highways, property, minerals) on top of the base geography. There is a major opportunity to share GIS applications and data to provide consistent, high quality and cost-effective service across Government and to clients.

Deeds Registration (Shared): Numerous departments within government along with municipalities, companies and the general public need access to information on property ownership. A Deeds Registration System with Government-wide and external access would greatly streamline property-related transactions. This also presents an opportunity for cost recovery by charging external users for this service. This application may be linked to other opportunities including GIS, Client Database and Property Assessment.

Property Assessment (Shared): Like Deeds information, Government departments, municipalities, companies and the general public need to access information relating to property assessments. There are also links from this application that can be made to GIS and Client Database which are other common opportunities. Every piece of property assessed has to have a geographical location and each owner of that property can be regarded as a client. A shared Property Assessment System would improve service and streamline overall administration.

Procurement (Corporate): All departments within government procure materials, fixed assets and services from outside suppliers. Procurement deals with the purchasing process including requisitioning, tendering, contracting, purchasing, receiving, payment and supplier evaluation. There is an opportunity for a corporate system with communications between all departments and the central purchasing agency as well as links to suppliers. Such a system could significantly streamline the procurement process, reduce costs and enable the tendering process to be more open.

Licensing (Common Components): Many departments within government issue licenses for a wide variety of purposes (e.g. drivers, hunters, firearms, liquor, vehicle safety inspection). Even though there is a wide diversity in the data stored for each license and the format of the license, the license application and issue processes have much in common. There is therefore an opportunity here to share some applications functions across departments. The benefits include reduced development costs and the ability to integrate the delivery of licensing services in Government.

It is recognized that there are many other opportunities for common systems across Government. There is a need for an organizational process and framework to identify and pursue these opportunities on an ongoing basis.

6.0 ARCHITECTURE MIGRATION

This section outlines the long-term architecture migration strategy, the short-term implementation steps and the organizational factors that must be addressed.

6.1 Migration Strategy

In Chapter 4, specific migration issues and strategies for applications, information and technology were outlined. This section presents coordinated strategies for migration to the target IT architecture in terms of migration principles, migration plateaus and co-existence strategies.

6.1.1 Migration Principles

The following are migration principles established by the Architecture Planning Steering Committee to guide the evolution to the target IT Architecture:

1. The target architecture is dynamic and must be updated over time.

2. There is a requirement for an ongoing coordination function for the evaluation, establishment and maintenance of the architecture standards.

3. There is a requirement for Government-wide participation in the ongoing migration process.

4. Non-compliant technical environments will not be allowed to proliferate although there may be specific legitimate requirements for limited expansion of existing environments in the short-term.

5. Departments must take proactive steps to become familiar with and to introduce standard environments in their organizations . Long Range Systems Plans should be reviewed and updated to reflect the Architecture standards and to define their migration strategies.

6. Short-term strategies should be encouraged to camouflage non-compliance (i.e. to facilitate co-existence).

7. Consideration of special assistance may be required for some departments with major existing non-compliant investments - departments should not be penalized for taking steps towards standards compliance..

8. Short-term platform co-existence will be recognized with consideration of replacement at the time of the next upgrade.

9. A general short-term focus is required on infrastructure and organization development projects.

6.1.2 Migration Plateaus

The target IT architecture is a ten year plan for the Government that involves fundamental change across the IT infrastructure. Migration can be more effectively managed if it is defined as a series of steps or plateaus leading to the target architecture. Key characteristics of three migration plateaus have been defined as follows:

1. First Plateau

    - 2 to 4 year timeframe
    - standard work group environments
    - continued terminal emulation
    - structured databases for end-user computing
    - migration approaches for redesigned applications
    - new applications comply with standards (e.g. development environment, generic user interfaces, platforms, etc.)
    - Government-wide electronic mail capability
    - Government-wide electronic data interchange capability
    - Rationalized peer-to-peer data network with voice integration on the carrier.

2. Second Plateau

- 4 to 6 year timeframe
- data entry at source including scanning capability
- inquiry capability for end users and external users
- optical disk for data storage and retrieval
- full graphical user interface implementation - no terminal emulation
- voice integration at the workstation
- current environments as background processing.

3. Third Plateau

- 7 to 10 year timeframe
- full network computing environment
- current applications re-engineered
- MVS replaced
- video integration at the workstation.

6.1.3 Co-existence Strategies

The migration to the target IT Architecture will impact all levels and areas of Government. However, in the short-term there are particular areas where there are significant current investments in non-conforming technologies. Examples include:

- Macintosh environments;
- CTOS (MDS) environments;
- Mainframe SNA environment;
- Dumb terminals (3270 and ASCII);
- Non-compliant Departmental computers;
- Low-end DOS environments (808X, 286); and
- Non-compliant LAN servers.

Short-term co-existence plans will be required for each of these environments. These plans should define approaches to facilitate co-existence of these technologies with the emerging standards and to take advantage of the useful life of the existing equipment. For the longer term, departments will be expected to develop specific migration plans to the standard technology environments.

6.2 Architecture Implementation Plans

A ten year migration strategy to evolve towards the target IT architecture was presented above. However, it is essential that immediate steps be taken in the short-term to put the migration in motion. An implementation plan of eleven tasks that should be initiated within the 1991/92 fiscal year is outlined below. (The requirements for portfolio funding have been indicated where appropriate.)

1. Workgroup Computing Trial

    - technology trial
    - integration testing
    - support planning
    - May to June timeframe (portfolio funding required).

2. Workgroup Computing Pilots

    - pilot planning
    - user implementation in a minimum of 3 departments
    - June to October timeframe (portfolio funding required).

3. Wide Area Network Plan

    - requirements definition and technical design
    - vendor negotiations
    - implementation plan
    - June to September timeframe (portfolio funding required).

4. Common Workgroup Computing Environment Plan

   - implementation plan for each department
   - assumes implementation of the wide area network
   - October to February timeframe.

5. Application Server Technology Evaluation

   - confirm operating system environment
   - confirm standard development environment
   - vendor negotiations
   - November to March timeframe (portfolio funding required).

6. Development Environment Implementation

   - Productivity Plus TM implementation planning
   - evaluation/selection of standard tools
   - implementation of pilot developer's workbench
   - plan by September; implementation ongoing (portfolio funding required).

7. New Applications Implementation

   - select candidate new applications
   - implement on standard application server environment
   - October to February timeframe.

8. IT Planning Process

   - action the third "key thrust" from 1990 IT Planning Study to "Develop a cross-departmental IT strategy"
   - establish the planning approach by September (portfolio funding required).

9. IT Organization Design Project

   - develop an organization redesign plan
   - address the issues identified by the working group
   - plan to be prepared by September (portfolio funding required).

10. Communication of the Architecture Plan

- plan for and action communication of the architecture plans to Management Board, Cabinet, Deputy Ministers, MIS Coordinators, and vendors
- plan to be prepared by May (portfolio funding required).

11. Ongoing Architecture Planning and Management

- provide focus and direction to architecture implementation tasks
- establish specific plans for tasks 1, 2, 3, & 10 by May (portfolio funding required)
- develop specific IT strategies for major sectors of Government activity (e.g. Education, Health Care)
- establish an organizational process and framework to identify and pursue common systems opportunities on an ongoing basis.

6.3 Organizational Considerations

The fifth "key thrust" of the 1990 IT Planning Study was to "Address IT organization and staffing needs". Although the first priority was to address Architecture Planning, it was decided that the organization implications of the plan were likely to be significant and that a baseline assessment of the IT organization should be established in parallel with the Architecture Plan. An IS Organization Assessment working group was established to:

- Conduct a baseline assessment of information systems management and staff across the Government;

- Identify information systems organizational issues.

A survey was conducted across all Government departments seeking baseline information on MIS coordinators, dedicated IT staff, informal IT staff and contracted IT services.

6.3.1 Current Organization Assessment

The key conclusions drawn from the survey results are outlined below.

Composite Government IT Staff

- The Government employs the equivalent of 300 full-time IT staff.
- 10 departments have no dedicated IT staff or full-time MIS coordinators.
- Close to half the staff are employed by SCS (137 staff including development and operations); four other departments have 63% of the remaining staff.

MIS Coordinators

- Only nine departments have dedicated MIS coordinators.
- On average, MIS coordinators spend less than half their time on MIS related functions.
- MIS coordinators are highly educated, (50% have post-graduate level training) but only 10% have academic training in computer science.

Dedicated IT Staff

- IT Staff spend 20% of their time on system development activities.
- 64% of IT staff time is spent on mainframe based systems.
- 45% of IT staff have no formal MIS education.
- Dedicated IT Staff receive an average of 4.5 days training annually.

Informal IT Staff

- 165 Government employees provide informal MIS support within their respective departments (equivalent to approximately 32 full-time person years).
- 114 (of the 165) informal IT staff are classified as MCP's or PR/TE.
- The majority of their IT effort is spent on production-related support activities for microcomputer based applications.

Contracted IT Services

- The Government employs the equivalent of 39 person years of contracted IT services and 14 person years of term or casual IT services.

6.3.2 IT Organization Issues

The working group identified IT organizational issues in 7 areas. Selected key issues are presented below:

1. Strategic Planning and Organizational Policy
    - Strategic IT planning must include human resource and organizational implications.
    - Existing SCS chargeback policies must be reviewed with regards to their effect on organizational effectiveness and resource allocation decisions.
2. Corporate IT Structure
    - IT management and technical support must be provided for all departments and agencies.
    - Organizational models must be evaluated to determine the most effective placement of IT staff resources.

3. Training

- Appropriate training funding must be made available for It staff and users to facilitate implementation of the new architecture environments.

- Management of IT training must be coordinated centrally.

4. Career Management

- IT professionals must be provided with full career path potential within their profession or in other management areas.

- Opportunities should be available for exchanges, transfers, and promotions between departments and for exchanges with industry.

5. Resources

- Recognition must be given to the need to adequately staff IT within departments and agencies to enable the full benefits of the architecture implementation.

- Structures and procedures must be implemented to allow for greater mobility/flexibility of IT staff resources across Government.

6. Non-dedicated IT Staff Support Effort

- Informal IT support effort must be evaluated to determine effectiveness, nature and potential for shifting to dedicated IT staff.

7. User Implications

- User job functions and organization structures must be re-evaluated in light of changing roles brought on by increased implementation of IT across the Government.

6.3.3 Organization Recommendations

Organizational change is a pre-requisite for implementation of the new IT architecture. It is recommended that the Government immediately address the IT organization needs. The key issues have been identified and the current IT organization has been defined. Work should now be initiated to address these issues in conjunction with the architecture implementation.

APPENDIX A

GLOSSARY OF TERMS

ACD

see Automated Call Distribution

AI

see Artificial Intelligence

application

A computerized package of one or more work functions or management processes delivered to the user in an integrated manner

artificial Intelligence (AI)

a subset of computer science concerned with the programming of machines so that they mimic the reasoning and learning behaviours of human beings. AI implemented to create a human/machine interface refers to a program that enables the computer to respond to plain-language commands or inquiries, by utilizing human-like capacities for interpreting language. (Datapro Research CM95-008, July 1989)

attributes (of data)

A property or characteristic of one or more data entities. For example, colour, weight, and sex are attributes of the entity "employee". (Vocabulary for Data Processing, IBM GC20-1699-6, 1981)

automated call distribution (ACD)

The capability provided by a Private Branch Exchange to automatically route incoming calls to the first available extension.

bandwidth

the range of frequencies, expressed in hertz (cycles per second), that can pass through a circuit. It is a measure of the rate at which information can be passed through the circuit. (Datapro Research CM95-008, July 1989)

bit map

a method of creating images by assigning an individual memory location for each picture element (pixel) on the screen. (Datapro Research CM95-008, July 1989)

CASE

see Computer Assisted Software Engineering

centralized data processing

data processing performed at a single location. (Datapro Research CM95-008, July 1989)

cluster

a limited number of workstations attached to a control device. (Datapro Research CM95-008, July 1989)

communication server

see server

compiler

software that translates program instructions written in a high level language such as Basic, Fortran, COBOL, or PL/1 into object code (machine-level language) for execution by the system. (Datapro Research CM95-008, July 1989)

Computer Assisted Software Engineering (CASE)

a combination of technologies that facilitates the development of applications software. Elements can include distributed processing, graphical user interface, interactive debugging, and expert systems. (Datapro Research CM95-008, July 1989)

dial-up facilities

see dial-up link

dial-up link

a circuit that is established by a switched circuit connection; generally refers to the telephone network. (Datapro Research CM95-008, July 1989)

digital private branch exchange

a private branch exchange (cf) using digital switching techniques rather than manual switching

distributed data processing (DDP)

the use of computer systems or intelligent terminals at multiple sites within an organization to perform data processing and/or storage functions. (Datapro Research CM95-008, July 1989)

document server

see server

down load

to transmit a file or program from a central computer to a computer at a remote site. (Datapro Research CM95-008, July 1989)

electronic spreadsheet

a software package that defines an array of interrelated data; each entry could be a numeric value, a formula, or an arithmetic calculation, and the entries can relate to and/or affect other elements. (Datapro Research CM95-008, July 1989)

emulation

the imitation of one system's code set by another such that the two may communicate. A system that emulates another system can, in a communications session, accept and process the same data as the imitated system. (Datapro Research CM95-008, July 1989)

expert system

a software package that uses reasoning and representation techniques to model a problem. (Datapro Research CM95-008, July 1989)

a program that behaves like an expert in some, usually narrow, domain of application. Usually considered to consist of three modules; a knowledge of rule base (cf), an inference engine (cf) and a user interface. (PROLOG Programming for Artificial Intelligence, Ivan Bratko, Addison-Wesley 1986)

fileserver

see server

fourth generation

from 1975: a software advance - the introduction of non-procedural languages. (Datapro Research CM95-008, July 1989)

GAE

General Application Environment.

gateway

a conceptual or logical network station that serves to interconnect two otherwise incompatible networks, network nodes, subnetworks, or devices; gateways perform a protocol-conversion operation across a wide spectrum of communications functions or layers. (Datapro Research CM95-008, July 1989)

Graphical User Interface (GUI)

a user interface that uses the mouse and a bit-mapped graphics display to make basic computer operations substantially easier for novices. (Computer User's Dictionary, QUE Corporation, 1990)

GTE

Generic Technology Environment.

GUI

see Graphical User Interface

hard copy

machine output in a permanent, visually readable form, for example, printed reports, listings, documents and summaries. The term has gained significance in light of the use of magnetic records which require processing. (Datapro Research CM95-008, July 1989)

host

the primary or controlling system in a multiple computer network operation. (Datapro Research CM95-008, July 1989)

icon

a symbol or pictorial representation of an object or idea. In graphic interfaces, icons are used to represent the different functions and locations available to the user, and a mouse is used to select the desired operation by pointing to one of the icons on the screen. A icon-based interface is inherently a menu-based system, because it presents a menu of symbols (as opposed to a menu of commands) from which to choose. (Datapro Research CM95-008, July 1989)

inference engine

a program that knows how to actively use the knowledge base (cf). (PROLOG Programming for Artificial Intelligence, Ivan Bratko, Addison-Wesley 1986.) See expert system

integration

a term used to describe the bringing together of different computer-based functions, such as electronic spreadsheet, word processing, data processing, and telecommunications, into a single system with a unified user interface.

In larger systems, integration refers to the meshing of incompatible systems with communications interfaces that allow the different systems to communicate. (Datapro Research CM95-008, July 1989)

intelligent (workstation)

a workstation with some logical capability; a remote device that is capable of performing some editing or other function upon or output data; contrast with dumb terminal. (Datapro Research CM95-008, July 1989)

interface

a shared boundary defined by common logical or physical interconnection characteristics, signal characteristics, and meanings of interchanges signals. (Datapro Research CM95-008, July 1989)

juke box

a disk drive for optical (compact) disks which contains several disks and allows computer controlled selection of which disk to be read

knowledge base

a database comprising the knowledge that is specific to the domain of application of an expert system (cf). (PROLOG Programming for Artificial Intelligence, Ivan Bratko, Addison-Wesley 1986)

LAN

see Local Area Network

link

a communications path between two points. (Datapro Research CM95-008, July 1989)

Local Area Network (LAN)

a system of multiple interconnected devices which exhibits the following characteristics: it is usually intracompany, privately owned, user-administered, and not subject to CRTC regulation. It is structured so that multiple devices are interconnected by a continuous medium such that equipment and applications, i.e. data/word processors, electronic mail, can operate over a single set of cabling. It is operable within a limited geographic area, usually with a maximum distance of 50 kilometres. It supports high-speed transmission at a minimum rate of 200 bps for low-speed LANs based on twisted-pair wiring to a maximum of about 140M bps for commercially available fibre optics. (Datapro Research CM95-008, July 1989)

Logical Operating Unit (LOU)

See Section 3.1 for a complete definition

LOU

Logical Operating Unit. See Section 3.1 for a complete definition

mail server

see server

mainframe

a class of computer providing large storage capacity, high-speed processing, and complex data handling capabilities. (Datapro Research CM95-008, July 1989)

monitor

a device used to display computer-generated information. (Datapro Research CM95-008, July 1989)

mouse

a handheld device, separate from a keyboard, used to control cursor position on a display screen. As the mouse rolls along a tabletop, its relative position approximates the position of the cursor. (Datapro Research CM95-008, July 1989)

multiplexing

the division of a transmission facility into two or more channels either by horizontally splitting the frequency band transmitted by the channel into narrower bands, each of which is used to constitute a distinct channel, or by allotting this common channel to several different vertical information channels one at a time. (Datapro Research CM95-008, July 1989)

multiprocessing

the ability of a computer system to allocate tasks to run concurrently on separate processors

multitasking

the ability of a computer system to perform multiple tasks, such as printing, sorting files, and text editing, at the same time. Multitasking is a function of the operating system, which controls the operation of the computer. (Datapro Research CM95-008, July 1989)

network

communications pathway between computers or between terminals and computers connected for a common purpose. (Datapro Research CM95-008, July 1989)

node

the termination point for two or more communications links. The node can serve as the control location for forwarding data among the elements of a network or multiple networks, as well as performing other networking and, in some cases, local processing functions. (Datapro Research CM95-008, July 1989)

Open Systems Interconnection (OSI)

a seven-layer network architecture, standardized by the International Organization for Standardization (ISO) that is being used to define communications pathway standards. (Datapro Research CM95-008, July 1989)

optical scanner

see scanner

OSI

see Open Systems Interconnection

outage

an interruption of service

PBX

see Private Branch Exchange

peer-to-peer

a file sharing technique for local area networks in which each user has access to the public files of all other users in the network located on their respective workstations. (Computer User's Dictionary, QUE Corporation, 1990)

print server

see server

Private Branch Exchange (PBX)

a manual phone switch connected to the public telephone network on the user's premises and operated by an attendant supplied by the user. (Datapro Research CM95-008, July 1989)

protocol

a formal set of conventions governing the orderly exchange of information between communicating devices by defining such things as connection establishment, security provision, data sequencing, error control, etc. Protocols achieve efficient line utilization by reducing the amount of information transferred by distinguishing between device control information and data. (Datapro Research CM95-008, July 1989)

queue

storage areas within a computer system, with each item in storage linked to the items before and after it to form a queue or line. Queues are usually created to permit an individual operator to send text to be processed (for such functions as data communications or printout) and to then continue to perform other work rather than waiting for access to the appropriate function or peripheral. (Datapro Research CM95-008, July 1989)

remote access

communications with a computer by terminal stations that are geographically removed from the computer. (Datapro Research CM95-008, July 1989)

rewritable optical storage

optical disk technology which permit erasure of the information held on the disk, and the subsequent writing of new information in the same space. Contrast with Write-Once-Read-Many (WORM) technology which cannot be erased, and each new copy of information uses additional media space until the disk is full of "old" information.

rule base

a database containing a list of relationships between facts (cf) and goals which must be satisfied for a fact to be true.

see knowledge base

scan server

see server

scanner

a peripheral device that digitizes artwork or photographs and stores the image as a file that can be merged with text in many processing and page layout program. (Computer User's Dictionary, QUE Corporation, 1990)

security

the quality or state of being cost effectively protected from undue losses (e.g. loss of good will, monetary loss, loss of ability to continue operations, etc.). (Canadian Vocabulary of Information Technology Security (INFOSEC), Version I, May 1990)

server

a device (usually a computer) in a local area network that provides services for users of the network. The server receives requests for peripheral services and manages the requests so that they are answered in an orderly, sequential manner. (Computer User's Dictionary, QUE Corporation, 1990)

shared-resource system

a multiterminal system configuration whereby a number of intelligent, independent workstations share common peripheral devices such as printers, scanners, disk files, etc. (Datapro Research CM-95-008, July 1989)

switch (PBX)

see Private Branch Exchange

switching system

see Private Branch Exchange

trusted

employing sufficient integrity measures (hardware and/or software) to allow its use for simultaneously processing a range of sensitive or classified information. (NCSC-WA-001-85)

voice synthesis

computer-generated sounds that simulate the human voice. (Datapro Research CM95-008, July 1989)

WAN

see Wide Area Network

Wide Area Network (WAN)

a computer network that used high-speed, long-distance communications networks or satellites to connect computers over distances greater than the distances traversed by local area networks. (Computer User's Dictionary, QUE Corporation, 1990)

workstation

a basic physical unit of a system which may be comprised of such hardware features as a display, keyboard, and media drive(s). (Datapro Research CM95-008, July 1989)

APPENDIX B

IT STRATEGIC DRIVERS

It has been agreed that a series of prioritized criteria, or "strategic drivers" be established to aid in setting priorities for:

a) when each Department is updating its Long Range Systems Plan (LRSP).

b) ranking projects for funding for the 91/92 fiscal year.

Six "strategic drivers" have been developed. They are presented in order of priority. Generally speaking, projects that meet one or more higher ranked criteria would be more likely of funding than, for example, projects that fulfilled lower ranked criteria. The matching of projects to criteria and relative priority setting will not be a rigid process, but rather a logical filtering process tempered with common sense.

STRATEGIC DRIVERS

1. The prioritization of Information Technology initiatives and investments must reflect **Government priorities.**

2. Investments in Information Technology must support the Government's **fiscal strategy** by reducing expenditures and/or increasing revenues.

3. Information Technology must focus on meeting evolving requirements for **client service.**

4. Information Technology must be used to simplify and **streamline Government** structures, processes and procedures.

5. Initiatives in Information Technology must support the Government's **Economic Development** strategy.

6. Information Technology must provide information and tools which support informed **management decision making,** and accountability.

The following describes the six "strategic drivers" in more detail.

STRATEGIC DRIVER 1

The prioritization of Information Technology initiatives and investments must reflect Government priorities. This is the key overriding strategic driver which addresses the business reality of changing and emerging Government policy and legislation.

STRATEGIC DRIVER 2

Investments in Information Technology must support the Government's fiscal strategy by:

reducing expenditures through:

- consolidating services;
- focusing program benefits, eligibility entitlements, and delivery;
- increasing staff productivity;
- improving use of other resources;
- supporting downsizing initiatives;
- obtaining outside sources of funding through partnerships; and/or

increasing revenues through:

- improving collections;
- expanding opportunities for charging for services (current and new);
- improving asset and investment management.

STRATEGIC DRIVER 3

Information Technology must focus on meeting evolving requirements for client service by ...

- Reducing the points of client contact through coordinated delivery of Government services and programs, including inter-government (e.g. "One Stop Shopping");
- Improving access to and consistency of service delivery across the province;
- Improving responsiveness to client requests for services and information, including supporting direct user access;
- Improving the quality of client service; and
- Developing pro-active approaches to service delivery (e.g. Predetermined eligibility, renewals).

STRATEGIC DRIVER 4

Information Technology must be used to simplify and streamline Government structures, processes and procedures by ...

- Encouraging inter-departmental planning and coordination of program initiatives;
- Enabling opportunities to consolidate service delivery and flatten the organization;
- Moving the decision-making capability to the point of client contract;
- Reducing the number of steps involved in processing transactions;
- Improving internal and external communications and access to information through the use of electronic information exchange and storage;
- Addressing the need for sharing of information across departments and programs;

- Providing common applications and services; and
- Utilizing common services, tools and methodologies.

STRATEGIC DRIVER 5

Initiatives in Information Technology must support the Government's Economic Development strategy by ...

- Fostering the development of a local Information Technology industry and capability through:
    - contracting out Information Technology services
    - partnerships and joint projects with industry, educational institutions and R & D organizations
    - focused training and education programs
- Providing information and tools to government policy makers for macro economic assessment including analysis, modelling and simulation capabilities;
- Using Information Technology to support privatization initiatives; and
- Providing Nova Scotia industry direct access to Government programs and information.

STRATEGIC DRIVER 6

Information Technology must provide information and tools which support informed management decision making, and accountability by ...

- Providing key result measurements (e.g. program effectiveness, resource utilization); and
- Focusing on service delivery.

APPENDIX C

IT ARCHITECTURE PRINCIPLES

Information Technology Architecture Principles

Working Draft

Architectural Working
Group Sessions

January 23, 1991

General Principles

#1 - Integration

The I.T. Architecture must provide the capability for integrating and managing the diverse and dispersed business operations of the Government

#2 - Client Focus

Systems will be planned and developed to address the needs of Government clients

#3 - Flexibility

The I.T. architecture should promote the development of information systems that can both enable and respond to changing business conditions and technology upgrades in a timely and cost efficient manner

#4 - Common Business Functions

Across all Government departments and agencies, we will identify and exploit opportunities for common functions to take advantage of standard applications, information and technology

General Principles

#5 - Industry Standards

Our choices for application and system components will be based on industry standards where applicable and available, and preference will be given to standards which are supported by multiple vendors

#6 - Leveraged Development

I.T. solutions will make use of purchaseable, sharable and reusable components as much as possible rather than custom designing and developing

#7 - Methodologies

Applications, information, and technology should be planned, developed, implemented and maintained using a consistent set of methodologies and tools across all departments and agencies

#8 - Risk Management

The I.T. architecture will provide secure operation and ensure the integrity and confidentiality of Government information in accordance with established security and service levels

Work Organization Principles

#1 - Data Capture

Data will be captured once, as close to the logical source as possible, including external sources

#2 - Digital Form

Information will be stored and transferred between parties (internal and external) in digital form where feasible and cost effective (e.g. direct deposit)

#3 - Access to Information

Information will be made available in an effective manner to those who are entitled to view it, including clients and external users.

#4 - Flexibility

The IT Architecture should support employees who perform multiple roles, independent of location and organization structure

Application Principles

#1 - Common Requirements

Where common requirements exist, the planning and development of application systems will promote the use of "Corporate" systems (E.g. HRMS, Finance), shared interdepartmental systems (e.g. Justice, Home Care) and common decentralized systems (e.g. Inventory, Library Systems)

#2 - Reusability

Application systems should be structured to use standard components and processes across Government (e.g. name and address processing, account verification, direct deposits)

#3 - Application Placement

Cost-effective, quality service to clients will be the primary factor in determining where an application should reside.

#4 - Separation by Type

The architecture will promote the separation of applications and information that provide transaction processing, decision support and report processing.

#5 - User Interface

Within a given user class and workstation type, applications should present a common user interface that is adaptable and extendable to particular user requirements

Application Principles

#6 - Information Exchange

Electronic information exchange should be conducted using exchange applications which are based on a standard set of formats and protocols (e.g. file transfer).

Information Principles

#1 - Forms of Information

The Government architecture and implemented systems must accommodate the use of all forms of information (data, text, voice, image).

#2 - Placement of Information

Cost-effective, quality client service is the primary focus for determining the level of distribution of information.

#3 - Standard Data Definitions

Information definitions will be standardized across all Government departments and agencies.

Technology Principles

#1 - Flexibility

The Nova Scotia Government will choose technology components such that expansion, reconfigurations, upgrades and substitutions can be easily accomplished

#2 - Multiple Levels

Processing, storage, communication, and workstation technologies must be placed at multiple levels in the architecture in accordance with dispersed business operations

#3 - Intelligent Workstations

Intelligent workstations will be the primary means of interfacing with applications

#4 - Network Standards

The N.S. Government will use a common set of network environments standards to interconnect all workstations, computers, and communicating devices

#5 - Common Services

Common services such as file transfer, electronic mail, directory management, and network management should be provided through an integrated networking environment(s)

General Principle #1 - Integration

The I.T. Architecture must provide the capability for integrating and managing the diverse and dispersed business operations of the Government.

Rationale...

- There is increased recognition of the need for inter-related Government operations - cooperative functions, shared information, common clients
- Individual employees must be empowered with the information and tools they need to perform their work in an efficient and effective manner
- Integration of systems will minimize redundancy and facilitate the cost-effective delivery of services
- Supports Strategic Drivers 1,2,3,4,6

Implications...

- There is a growing need for coordinated planning, both at the strategic level and at the application level
- There is a need to break down traditional barriers and build a new vision of operations
- I.T. architecture should be independent of organizational structure
- There is a need to address both internal and external linkages
- I.T. delivery platforms should be architected for shared or common requirements
- I.T. planning, budgeting and management processes must support cross-departmental initiatives
- Service delivery capabilities must be expanded, requiring a broadening of skills and training

General Principle #2 - Client Focus

Systems will be planned and developed to address the needs of Government clients

Rationale...

- Reflects the Government's intention to improve client service through improved quality and responsiveness, including direct client access to systems where appropriate
- Extends outreach of Government service to enable more equal access and consistent program delivery across the Province
- Quality of service is a key measure of Government and one that is most visible
- There is a need for coordination of the delivery of multiple programs for the same client
- Supports Strategic Driver 3

Implications...

- Requires a coordinated view of the client (e.g. a common I.D.)
- Requires coordinated planning of delivery systems
- There is a need for investment in the infrastructure (technical and physical) for coordinated service delivery; there must also be a mechanism for allocating such investments
- Requires strategy for promoting public awareness and confidence, particularly concerning privacy and confidentiality issues
- There is a need for legislative changes regarding information sharing and common coding
- There is a need to segment information on the basis of confidentiality

General Principle #3 - Flexibility

The I.T. architecture should promote the development of information systems that can both enable and respond to changing business conditions and technology upgrades in a timely and cost efficient manner.

Rationale...

- The I.T. architecture should address a long term (e.g. ten years) planning horizon
- Legislative changes affecting I.T. requirements are expected
- The architecture must effectively incorporate advances in technology
- There is a recognition of the role of I.T. in facilitating organizational change
- There is a need to provide increased delivery flexibility and an improved level of service
- Supports Strategic Drivers 1,3,4

Implications...

- Must choose a well defined set of components (applications, information, and technology) and associated standards and guidelines
- Allows for architectures where components can be replicated across multiple locations or for multiple uses
- Where replication is desirable, standards must be considered and need for managing consistency must be determined
- Need to prove new or emerging technologies before implementing while remaining technologically current
- Need an on-going process to manage architectural choices, migration and evolution
- Up front investment in architectural planning and resulting infrastructures is required for longer term gain

General Principle #4 - Common Business Functions

Across all Government departments and agencies, we will identify and exploit opportunities for common functions to take advantage of standard applications, information and technology

Rationale…

- Reduces redundant design, development and implementation effort
- Use of common solutions supports integration and flexibility (Principles 1 and 3)
- Provides opportunities for sharing components with and using components from other Government systems
- Supports Strategic Drivers 1,2,4,6

Implications…

- Requires a planning process for driving out common requirements
- Requires a process for choosing and arbitrating choice of standards and variance process
- Requires a registration, distribution and control mechanism for reusable/sharable components and for addressing ownership issues
- Requires different levels of standards, application, technology and methodology
- Must address privacy issues

General Principle #5 - Industry Standards

Our choices for application and system components will be based on industry standards where applicable and available, and preference will be given to standards which are supported by multiple vendors

Rationale...

- Reduces dependency on specific vendor(s) and fosters competition and lower costs
- Increases opportunity for connectivity and integration
- Reduces the need for developing custom standards
- Facilitates approval and procurement processes
- Facilitates support and training
- Supports Strategic Drivers 2,4

Implications...

- Requires a process for establishing and managing standards
- Requires knowledge of I.T. industry trends and vendor adoption of current and emerging standards
- The preference should be to adopt a minimum set of choices for each component
- Requires a procedure to encourage / ensure the appropriate level of compliance
- Within the Government-wide standards and guidelines, individual departments may choose to further restrict choices or to set standards in areas not addressed by the Government-wide standards
- A set timetable is required for migrating to the new standards
- A support mechanism is required to facilitate adoption of industry standards
- Cabinet awareness required

General Principle #6 - Leveraged Development

I.T. solutions will make use of purchaseable, sharable and reusable components as much as possible rather than custom designing and developing

Rationale...

- Minimizes risk (or transfers risk to the supplier)
- Should be more cost effective - shared costs
- More timely implementation
- Facilitates support and training
- Supports economic development strategies
- Supports Strategic Drivers 2,4,5

Implications...

- Architectural compliance should be the first consideration in evaluating leverage options
- Buy / share / reuse vs. make decision points should be identified in the methodology
- Criteria for evaluation of buy / share / reuse vs. make are required
- Some modification or change in requirements may need to be assessed (i.e. may have to adapt to the solution in some cases)
- May present areas of non-compliance with architectural standards for trade-off assessment where business considerations prevail
- Requires coordination of licensing and rights of use
- Can create vendor / supplier dependencies (risk)
- Reinforces need for interface standards

General Principle #7 - Methodologies

Applications, information, and technology should be planned, developed, implemented and maintained using a consistent set of methodologies and tools across all departments and agencies

Rationale...

- Promotes a consistent project management infrastructure across projects
- Promotes interchange and sharing of personnel
- Supports the means of prioritizing projects - all types
- Supports consistent communication (definitions, scope, status, etc.)
- Supports procurement of development services and software through specification of deliverables and project reporting
- Facilitates training and support
- Supports Strategic Driver 4

Implications...

- All players must agree to the rights and obligations contained in the methodology(s)
- Need to acquire/build an integrated set of methodologies and tools
- Conformance requirements by internal and external service providers
- Form and media for deliverables, including software, documentation, training, and project updates must be considered, along with the use of common or compatible tools
- Key requirement is definition of standard deliverables, not necessarily process
- The choice of tools requires consideration of platform-specific needs
- Management processes and reviews must link to the methodologies
- Management and support of methodologies must be addressed

General Principle #8 - Risk Management

The I.T. architecture will provide secure operation and ensure the integrity and confidentiality of Government information in accordance with established security and service levels

Rationale...

- Increased dependency on I.T.-based applications to support critical Government operations
- Extending the outreach and user base increases the security risk
- The architecture must support qualified access to information, respecting privacy and confidentiality

Implications...

- Requires a process for authorization, validation, and management of access privileges across multiple levels
- Need to address survivability from disasters, sabotage, and extended outages
- Need for recovery management across the network
- Requires procedures for auditability and accountability
- Security and access controls should be built into the architecture and work functions such that they do not impede the process (e.g., trusted communications transferring log on privileges)

Work Organization Principle #1 - Data Capture

Data will be captured once, as close to the logical source as possible, including external sources

Rationale...

- Minimize redundancy
- Productivity - minimize.entry / re-entry work and paper flow
- Fast Access - information that is 'sharable' (used by more than one function) would be available to all requiring it quicker (or simultaneously)
- Improved service to the public
- Consistency of Information - capture of information that is common to multiple applications contributes to consistency of this information across Government

Implications...

- Integrated Design
- Responsibility for Data Entry
- Data Interchange Standards
- Definition of Data Entry
- Ability to Capture Data
- Roles of central agency and departments
- Public perception - confidentiality and privacy (refer to Federal example - databases
- Change in jobs
- Reallocation of resources to "front end" - requires Management

Work Organization Principle #1 - Data Capture - Page 2

Rationale…

- Reduced errors
- Supports systems that are independent of organization structure
- Supports Strategic Drivers 2,3,4,6

Work Organization Principle #2 - Digital Form

Information will be stored and transferred between parties (internal and external) in digital form where feasible and cost effective (e.g. direct deposit)

Rationale...

- Responsiveness
- Integrity
- Availability
- Minimizing paper
- Productivity
- Supports Strategic Drivers 2,3,4

Implications...

- Importance of Standards
- Interfaces
- Financial investment in infrastructure
- Public perception / awareness
- Security and confidentiality issues
- Work organization / job changes
- Revenue Generation / Allocation of costs (e.g. for external links, common infrastructure)
- Potential for privatization - selling information

Work Organization Principle #3 - Access to Information

Information will be made available in an effective manner to those who are entitled to view it, including clients and external users.

Rationale...

- Improved Productivity
- Improved Service
- Supports shift to open Government & Freedom of Information
- Supports info sharing
- Supports Strategic Drivers 3,5,6

Implications...

- Security
- Directory: i.e. ease of finding data via a directory
- Requires a policy for ownership of data
- Legal Implications
- Communication of how data will be used - what about old data?
- Need organization / resources to manage

Work Organization Principle #4 - Flexibility

The IT Architecture should support employees who perform multiple roles, independent of location and organization structure

Rationale...

- Supports field workers
- Flexible HR management (broadened skills, adaptability)
- Supports Government "one-stop shopping"
- Improved service to public
- Increased lifespan of systems
- Promotes inter-organizational cooperation
- Improved productivity - streamlines workflow
- Supports Strategic Drivers 2,3,4

Implications...

- Security / audit controls
- Management structures - reporting lines
- Shift from measurement of process to the end product
- Labour relations issues
  - changing jobs, responsibilities
  - more generic positions
- Significant training program / investment

Application Principle #1 - Common Requirements

Where common requirements exist, the planning and development of application systems will promote the use of "Corporate" systems (E.g. HRMS, Finance), shared interdepartmental systems (e.g. Justice, Home Care) and common decentralized systems (e.g. Inventory, Library Systems)

Rationale...

- Supports rationalization of common programs (General Principle #4)
- Minimizes redundancy
- Promotes efficient use of resources
- Facilitates auditability of programs
- Reduces cost of development and maintenance
- Facilitates training and support
- Improves quality
- Supports Strategic Drivers 2,4,6

Implications...

- Need an organization and mechanism to drive and manage this - including budget / resource allocation
- Impacts roles and responsibilities
- Must be able to recognize unique requirements
- Impacts system delivery organization, process and standards to take advantage of common applications

Application Principle #2 - Reusability

Application systems should be structured to use standard components and processes across Government (e.g. name and address processing, account verification, direct deposits)

Rationale...

- Minimizes redundancy
- Promotes efficient use of resources through reusability
- Facilitates auditability of programs
- Reduces cost of development and maintenance
- Facilitates training and support
- Improves quality
- Supports Strategic Drivers 2,4,6

Implications...

- Need an organization and mechanism to drive and manage this - including budget / resource allocation
- Impacts roles and responsibilities
- Must be able to recognize unique requirements
- Impacts system delivery process and standards to take advantage of common modules
- Need a repository for common modules and documentation

Application Principle #3 - Application Placement

Cost-effective, quality service to clients will be the primary factor in determining where an application should reside.

Rationale...

- Recognize a multi-level architecture with different platforms at each level
- Support high level of service (e.g. ease of use)
- Support the empowered employee, particularly for responding to clients
- Supports decisions on placement of applications
- Supports driver on client service
- Supports optimized performance
- Logical user application distribution and execution for each application system
- Supports Strategic Driver 3

Implications...

- Applications can reside on multiple levels, cooperative
- Need to define architectural levels (e.g. personal, workgroup, departmental, corporate)
- Must consider other criteria to determine placement of applications i.e.:
  - Client service
  - Common requirements
  - Cost
  - Dependency on other applications
  - Performance
  - Data Management / Integrity
  - Application Complexity

Application Principle #3 - Application Placement - Page 2

Implications...

- Risk
- Data Ownership
- User Base
- Backup and Recovery considerations

- Management of highly dispersed environment will be more difficult (e.g. need procedures for backup and recovery
- Must support overall IT Architecture Principle 8 (Risk Management)
- Need to define what application environment will be supported on each level

Application Principle #4 - Separation by Type

The architecture will promote the separation of applications and information that provide transaction processing, decision support and report processing.

Rationale...

- Provides opportunities to optimize the system to achieve consistent service levels
- Users of individual applications (these three types) tend to be different people, and may be at different locations
- Allows possibility to use different levels of architecture and platforms
- Provides for clean interfaces
- Supports Strategic Driver 6

Implications...

- Need applications to manage separate information bases for reporting and analytical purposes
- Need a higher-level management of information (e.g. integrity, redundancy, and timeliness)
- Operating environment may be more complex

Application Principle #5 - User Interface

Within a given user class and workstation type, applications should present a common user interface that is adaptable and extendable to particular user requirements

Rationale...

- Supports ease of use (if user interface is well designed)
- Provides for lower training costs and increases staff mobility
- Reduces development and maintenance costs for application (over long-term
- Supports Application Principle #3, separation of functions
- Supports Strategic Drivers 2,6

Implications...

- Need to separate the user interface management from the application
- Extends applications because a system can be used in different ways - requires a variety of options to accommodate different user style
- Requires an evaluation of available user interface methodologies (refer to Overall IT Architecture Principle 6 (Leveraged Development)
- Need to define:
  - user class
  - workstation class

Application Principle #6 - Information Exchange

Electronic information exchange should be conducted using exchange applications which are based on a standard set of formats and protocols (e.g. file transfer)

Rationale...

- Supports internal and external exchange (EDI)
- Recognizes the need to co-exist with external agencies and services
- Simplifies application design by separating exchange functions from other application functions
- Supports inter-departmental information exchange
- Supports application Principle #3, separation of functions
- Supports Strategic Drivers 2,4

Implications...

- Where translation is necessary, it would be done by the exchange application
- Need to support bulk file transfer and message transfer
- Can be applied to manual media transfer (e.g. tape)
- Need audits and controls
- Must be developed and maintained
- Requires common data definitions

Information Principle #1 - Forms of Information

The Government architecture and implemented systems must accommodate the use of all forms of information (data, text, voice, image)

Rationale...

- Supports the way Government operates when dealing with clients (mail, phone, face-to-face)
- Supports the way employees interact
- Matches the personal style of communication to the situation
- Supports Strategic Driver 4

Implications...

- Early focus will be on data and text, the use of image and voice will evolve
- Capacity will increase as image and voice forms evolve (storage, transmission, bandwidth)
- Skills and experiences base will need to be addressed

Information Principle #2 - Placement of Information

Cost-effective, quality client service is the primary focus for determining the level of distribution of information

Rationale...

- Refer to Application Architecture Principle 2
- Refer to Application Architecture Principle 3
- Supports Strategic Driver 3

Implications...

- Need to define rights and obligations (e.g. ownership, custodian)
- Need to establish criteria to determine placement of information
- Need to address directory management

Information Principle #3 - Standard Data Definitions

Information definitions will be standardized across all Government departments and agencies

Rationale...

- Provides improved quality and consistency of information and improves overall effectiveness of implemented systems
- Supports Strategic Driver 4,6

Implications...

- Need to develop a policy for information management
- Need to define standard definitions (definition includes attributes of data) > A timetable must be established
- Need a means to access and communicate the data definitions to systems developers
- Applies across all levels in architecture

Technology Principle #1 - Flexibility

The Nova Scotia Government will choose technology components such that expansion, reconfigurations, upgrades and substitutions can be easily accomplished

Rationale...

- Supports the need for accommodating changes in business, organization, and technology
- Provides increased operational flexibility
- Supports efficient use of technology by sizing (tuning) platforms to meet local requirements and by allowing for component re-use
- Supports Strategic Driver 2

Implications...

- Technologies which support scalability (i.e., which can be configured to meet a wide range of capacity requirements) will be preferred over more limited choices
- Components and their associated standards must be chosen to encourage multi-vendor supply
- Some pre-investment may be required to support this principle

Technology Principle #2 - Multiple Levels

Processing, storage, communication, and workstation technologies must be placed at multiple levels in the architecture in accordance with dispersed business operations

Rationale...

- Recognizes varying needs for access and sharing of applications and information in different departments, levels of operation and management, and operating locations
- Provides flexibility for placing applications and information at different levels and different operating locations to optimize performance, availability, cost, management and other factors
- Supports Strategic Drivers 3,4

Implications...

- Processing levels required in the Government include personal computers, departmental processors and the central mainframe(s)
- Local and wide area networks are vital to the operation of the multi-level architecture
- Requires a means for determining and evaluating distribution options
- Introduces operational and management complexity
- Architecture must address the provision of support services for managing distributed environments

Technology Principle #3 - Intelligent Workstations

Intelligent workstations will be the primary means of interfacing with applications

Rationale...

- The business vision builds on the empowered user, which in turn suggests the need for multi-function capability at the workstation involving multiple forms of information - data, text, voice, and image
- Provides the ability to use advanced user interface management, supporting ease of use and consistency, on the workstation platform
- Provides a low cost processing platform which can be dedicated to local user functions (e.g. word processing, spreadsheets) or portions of shared applications, off-loading networks and host (server) computers
- Supports Strategic Drivers 4,6

Implications...

- Require WS standards
- Intelligent workstations can include PC's (with or without disks), high-end workstations, or intelligent terminals (e.g. X-terminals).
- Need to minimize the number of different workstation platforms supported by Government I.S. resources
- Primary determinant is type and sophistication of user interface management required, and other user applications resident on the workstation
- The use of "dumb terminals" should be limited to users who require only a small number of structured host-based applications.

Technology Principle #3 - Intelligent Workstations - Page 2

Implications...

- Users will assume responsibilities in operating and maintaining intelligent workstations, and procedures, support, and training will be required to address these responsibilities
- Need a migration plan
- Need policies to guide acquisitions - cost / investment

Technology Principle #4 - Network Standards

The N.S. Government will use a common set of network environment standards to interconnect all workstations, computers, and communicating devices

Rationale...

- Provides the basis for supporting a variety of connectivity options to meet business needs
- Supports flexibility in addressing changes to business requirements and evolution of technology
- Limits the impact of changes
- Supports Strategic Drivers 3,4

Implications...

- Need to review and evaluate standards (e.g. OSI)
- Encourages the evaluation of various networking approaches which support client/server relationships
- Promotes the use of network connection of workstations to one or more servers rather than direct (port or channel) connection
- Some application and technology environments may require direct workstation connection, but these should be avoided or minimized
- These network environments include LAN's, switching systems, and WAN's and their interconnections
- Migration strategy required

Technology Principle #5 - Common Services

Common services such as file transfer, electronic mail, directory management, and network management should be provided through an integrated networking environment(s)

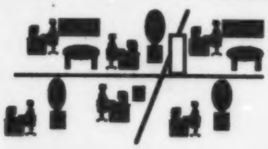
- Reduces duplication of effort for planning, implementing, and operating these service facilities
- Reduces complexity of applications
- Enables a broader range of applications and users to benefit from these services
- Provides opportunities for outsourcing to service providers (value-added network services), reducing costs, risks, management, and need for specialist skills
- Facilities outreach, equalization of service
- Supports Strategic Drivers 3,4,5

- Need to address interface standards
- Requires evaluation of potential VANs and types of relationships
- Some technological limitations will apply, especially in the area of distributed network management
- Management / support of distribution services

APPENDIX D

WORK LOCATION ARCHITECTURES

Work Location Architecture - 1



Head Office

Business Functions
- Policy/Planning
- Program Development/Implementation
- Internal Administration
- Providing Grants/Payments
- Inspecting/Auditing
- Revenue Collection
- Distributing Information
- Conducting Research
- Training/Educating
- Acquiring Goods/Services
- Marketing/Promotion

User Classes
- Executive
- Professional/Technical
- Clerical/Administrative
- Systems Developers

Applications
- Inquiry
- Reporting
- Decision Support
- Expert Systems
- Document Storage/Retrieval
- Document Processing
- Email
- Systems Development
- Imaging (CAD)

Information Classes
- Client (composite view)
- Program
- Organization
- Financial
- Resources
- Facilities

Technology
- Corporate Processor
- Departmental Processor
- Office Workstations
- LAN's
- Access to WAN

Work Location Architecture - 2

Regional Office

Business Functions
- Program Development/Implementation
- Internal Administration
- Providing Grants/Payments
- Inspecting/Auditing
- Revenue Collection
- Distributing Information
- Conducting Research
- Acquiring Goods/Services
- Marketing/Promotion

User Classes
- Executive
- Professional/Technical
- Clerical/Administrative
- Systems Developers

Applications
- Inquiry
- Reporting
- Decision Support
- Expert Systems
- Document Storage/Retrieval
- Document Processing
- Electronic Mail
- Systems Development
- Imaging (CAD)

Information Classes
- Client (composite view)
- Program
- Organization
- Financial
- Resources
- Facilities

Technology
- Regional Processor
- Departmental Processor
- Office Workstations
- LAN
- Access to WAN

Work Location Architecture - 3

Service Delivery Point

Business Functions
- Program Development/Implementation
- Internal Administration
- Providing Grants/Payments
- Licencing/Permits/Registration
- Inspecting/Auditing
- Assessing
- Consulting/Counselling
- Patrolling/Protecting
- Adjudicating
- Revenue Collection
- Construction/Maintenance
- Distributing Information
- Distributing Goods
- Training/Educating
- Health Care/Rehabilitation
- Acquiring Goods/Services
- Marketing/Promotion

User Classes
- Professional/Technical
- Service Delivery Officer

Applications
- Transaction Processing
- Data Capture
- Inquiry
- Reporting
- Expert Systems
- Document Storage/Retrieval
- Document Processing
- Electronic Mail

Information Classes
- Client (composite view)
- Program
- Organization (services)
- Financial
- Resources
- Facilities

Technology
- Workgroup/Application Processor
- Office Workstations
- LAN
- Access to WAN

Work Location Architecture - 4

Warehouse / Maintenance Facilities

Business Functions
- Internal Administration
- Inspecting/Auditing
- Construction/Maintenance
- Distributing Goods
- Acquiring Goods/Services

User Classes
- Professional/Technical
- Clerical/Administrative

Information Classes
- Client
- Program
- Organization (services, contracts)
- Financial (project)
- Resources
- Facilities

Applications
- Transaction Processing
- Data Capture
- Inquiry
- Reporting
- Decision Support
- Expert Systems
- Document Storage/Retrieval
- Document Processing
- Electronic Mail

Technology
- Workgroup/Application Processor
- Office Workstations
- LAN
- Access to WAN

Work Location Architecture - 5

Mobile Employee

Business Functions
- Inspecting/Auditing
- Assessing
- Consulting/Counselling
- Patrolling/Protecting
- Construction/Maintenance
- Distributing Information
- Health Care/Rehabilitation
- Acquiring Goods/Services

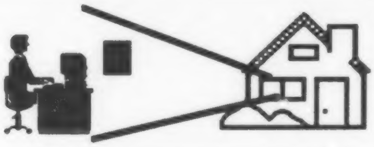
User Classes
- Professional/Technical
- Service Delivery Officer

Information Classes
- Client (composite view)
- Program
- Organization (services, contracts)
- Financial (assistance)
- Resources (information)
- Facilities

Applications
- Data Capture
- Inquiry
- Expert Systems
- Document Storage/Retrieval (specialized)
- Document Processing
- Electronic Mail

Technology
- Portable Workstation (possibly hand-held, rugged, mobile)
- Access to LAN, WAN

Work Location Architecture - 6



Employee at Home

Business Functions
- Internal Administration
- Consulting/Counselling
- Patrolling/Protecting
- Distributing Information
- Conducting Research
- Training/Educating

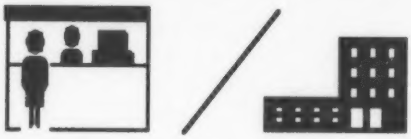
User Classes
- Professional/Technical
- Systems Developer
- Service Delivery Officer

Information Classes
- Client (composite view)
- Program
- Resources (information)

Applications
- Transaction Processing
- Data Capture
- Inquiry
- Expert Systems
- Document Storage/Retrieval
- Document Processing
- Electronic Mail
- Systems Development
- Imaging (CAD)

Technology
- Office Workstation
- Printer
- Access to LAN, WAN

Work Location Architecture - 7



Agents

Business Functions

- Providing Grants/Payments
- Licencing/Permits/Registration
- Inspecting/Auditing
- Assessing
- Consulting/Counselling
- Patrolling/Protecting
- Adjudicating
- Revenue Collection
- Distributing Information
- Distributing Goods
- Training/Educating
- Health Care/Rehabilitation
- Acquiring Goods/Services
- Marketing/Promotion

User Classes

- Agents

Applications

- Transaction Processing
- Data Capture
- Inquiry
- Expert Systems
- Document Processing
- Electronic Mail

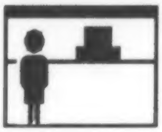
Information Classes

- Client
- Program
- Organization (services)
- Financial
- Resources (information)
- Facilities

Technology

- Workstation
- Processor
- Access to WAN

Work Location Architecture - 8



Nova Scotia

Self Service Location

Business Functions

- Licencing/Permits/Registration
- Assessing
- Consulting/Counselling
- Revenue Collection
- Distributing Information
- Health Care/Rehabilitation
- Marketing/Promotion

User Classes

- Clients

Applications

- Transaction Processing
- Inquiry
- Expert Systems
- Document Storage/Retrieval (special)
- Document Processing

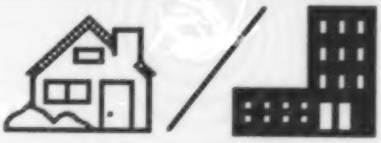
Information Classes

- Client
- Program
- Resources (information)
- Facilities (land)

Technology

- Special Workstation(s) (e.g. touch screen, rugged)
- Special Printers (e.g. forms)
- Access to WAN

Work Location Architecture - 9



Client/Supplier Premises

Business Functions
- Providing Grants/Payments
- Licencing/Permits/Registration
- Assessing
- Consulting/Counselling
- Revenue Collection
- Construction/Maintenance
- Conducting Research
- Training/Educating
- Health Care/Rehabilitation
- Acquiring Goods/Services
- Marketing/Promotion

User Classes
- Systems Developers
- Suppliers
- Clients
- Other Governments

Applications
- Transaction Processing
- Data Capture
- Inquiry
- Expert Systems
- Electronic Mail
- Systems Development

Information Classes
- Client
- Program
- Organization (contracts)
- Resources (information, materials)
- Facilities (land)

Technology
- Workstation
- Processor
- Access to WAN